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A REVIEW AND CONSIDERATION OF THE PROBLEM OF RETENTION

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IN REVIEWING the literature pertaining to retention one becomes impressed with the uncertainty surrounding this problem.

In the early literature retention is discussed very briefly; however most of the authors of this period advocate the support or "fixation," a term frequently used, of newly moved teeth until they have become firm in their new positions. Factors operating prior to, during, or after this fixation period are given little consideration.

In the texts of more recent authors, a similarity of opinion is expressed upon the subject of retention. To conserve time, only some typical thoughts expressed by the authors will be mentioned, and then the entire subject of retention will be summarized.

Angle in his *Malocclusion of the Teeth*, seventh edition, stated: "After malposed teeth have been moved into the desired position they must be mechanically supported until all of the tissues involved in their support and maintenance in their new positions shall have become thoroughly modified, both in structure and function to meet the new requirements."

Dewey stated in his *Practical Orthodontia*, fourth edition: "It has been said that the problem of modern orthodontia is one of retention. With the modern regulating appliances it becomes quite easy to regulate teeth, but to keep them in their new position has been difficult."

McCoy in his *Applied Orthodontia*, fourth edition, states: "Teeth and dental arches are not fixed units after tooth movement, and are subject to modifications and changes incident to growth and development."

Strang in his *Text Book of Orthodontia* discusses retention and states: "At the present time, though the orthodontist still is confronted with the problem

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of mechanical support after active treatment is over, yet he views it as a phase or a mere transitory stage of the whole period of treatment, its purpose being to afford an opportunity for those tissues that are to act as the natural and permanent maintainers of tooth and dental arch position to reconstruct their architectural forms in order to comply with the demands of the functional forces that play upon the denture."

In Anderson's revision of Dewey's *Practical Orthodontia,* fifth edition, the following statement appears in the chapter on retention: "Proper recognition of the requirements of physiologic tooth movement, so there will be no interference to normal cell functioning, is a sound background upon which the correction and retention of malocclusion may be undertaken."

Oppenheim in his "Crisis in Orthodontia," published in the INTERNATIONAL JOURNAL OF ORTHODONTIA, June and July, 1934, describes some of his histologic studies relating to retention. Four incisors of monkeys were moved in a labial direction by gentle intermittent force over a period of forty days. At the end of that period the appliances were removed.

One of the moved teeth was rigidly retained for three months; one was rigidly retained for six months; one was left without retention, allowing it to function freely for three months; and the fourth tooth that was moved was left without retention for six months. The animals were killed and sections made of the moved teeth and their surrounding structure.

From other experiments of tooth movement, Oppenheim showed that during active treatment the bone is widened, new bone is formed and the trabeculae become arranged parallel to the direction of the applied force. From the above mentioned experiment dealing with retention, Oppenheim's specimens showed that upon the removal of the pressure there was a gradual transformation and narrowing of the new bone simulating normal alveolar bone. In this new bone a normal lamellous structure is developing and the trabeculae are arranging themselves parallel to the long axis of the tooth. In the teeth which were rigidly retained this transformation progressed at a slower rate than in the cases in which the teeth were not retained, in which case they were receiving greater stimulation from the influence of function. Six months' time was not quite sufficient for the bone to return to normal in these experimental animals. As the results of these experiments were obtained from animals, their application to man must be made with reservations.

Oppenheim therefore contends that during retention the teeth should be permitted as much freedom as possible, thereby allowing for a quicker readjustment of the bone. He recommends that cases should be overcorrected, followed by a long period of retention.

An unusual practice is advocated by Skogsborg in an article entitled "The Permanent Retention of the Teeth After Orthodontic Treatment," published in the *Dental Cosmos,* 1927. He accepts Walkhoff's theory that a tension remains in the tissues owing to their elasticity after orthodontic treatment.

To overcome this tension, Skogsborg recommends the slitting of a small portion of the septum between the teeth from both the lingual and the labial surfaces. This practice, which is to be preceded by a period of mechanical retention, is advocated in selected cases which would have a tendency to relapse.

In contrast to the opinion of most authors, Mershon dispenses with retaining appliances, per se, and is opposed to the so-called period of retention. He contends that if during treatment an adjustment of the tissues is permitted through functional adaptation, which is aided by intervals of rest with the removal of appliances, no form of mechanical retention is required. Mershon feels that in this manner nature is permitted to be the controlling factor during treatment, thus reducing adaptative changes after the removal of the appliances. A statement of Mershon pertinent to this matter is: "You can move teeth to where you think they belong—nature will move them to where they will best adapt themselves to the rest of the organism."

Hellman's views upon retention have been expressed to me as follows: "Retention is not a separate problem in orthodontia but is the continuation of what we are doing during treatment. It is not a definite stage in treatment requiring a new technique. Therefore there is no need for separate machinery to carry it through. Retention is but a letting off of what we have been doing during treatment. The changes that we do make in our machinery are to ease up on the strains and stresses and to wean the tissues from the effects of our tinkering so that any change that is to be made, should be a reduction in the appliance. This can be done by changing either the type of appliance or the amount of time of wearing it. A complete result must be accomplished before retention is applied."

Taken from a review of the literature, the following factors have been laid down as being essential either prior to or during the retentive period:

1. The attainment of normal occlusion.
   a. Proper relationship of the inclined planes of the teeth.
   b. Proper arch form and arch relationship and correct overbite.
   c. No interruption of the proximal contact within the arches.
2. The removal of all factors that have been determined as causing or aggravating the malocclusion.
3. The placing of some form of mechanical device, usually as simple as possible, preventing the teeth from returning to their original positions.
4. Age.
5. Proper muscular tone and muscular pressure.
6. Good general health and normal health of the oral tissues.

From a review of the literature the following may be assumed:

1. Retention is the term applied by many authors to that procedure of maintaining the teeth and dental arches in a new position, assumed to be normal, after they have been moved from an abnormal position.
2. The period of retention, as described by many authors, applies to that time in orthodontic treatment when cases are to be considered completed or in the process of completion. This period is usually considered a definite and distinct stage in treatment. However, factors are included in this period which operate during active treatment.
3. The understanding that teeth are to be fixed or held after tooth movement, as expressed by the older writers, is still implied by many of the more recent authors. This conveys the idea that a static condition exists

after tooth movement. Some of the authors, however, differ from this viewpoint, and they show that the positions of the teeth may change long after orthodontic treatment has terminated.

4. The impression is given by many that following retention, the successful result obtained will remain permanent.

To consider properly the factors that have been presented from the literature concerning retention, they should be examined and compared with the results of our individual clinical experiences and with the scientific findings of research workers in the field of orthodontia and allied branches.

The attainment of normal occlusion, which is the first factor recommended for the commencement of retention, is the goal of all orthodontic treatment. According to the literature, the following conclusion is to be drawn; namely, when normal occlusion has been attained, and then retained for a period of time by special appliances, the result should remain permament following the removal of the appliances. This does not always hold true, as many excellent results have relapsed after the removal of the retainers.

In determining the extent to which normal occlusion may be attained, the factors of individual variation, the fact that different types may be classed as normal, and the fact that discrepancies may exist between the amount of tooth material and the amount of supporting structures as stressed by Lundström, should be given consideration during treatment. If this is not done, the effects of any form of retention may be futile.

It is inferred in the literature that where prominent cusps are present, they will assist in retention. Hellman has shown in his paper "Cusps and Occlusion," that in Class II Division 1 cases of malocclusion "The cusp types (high, low and medium) do not show any significant differences between cases which were successfully treated and cases which tend to relapse," after successful treatment.

Figs. 1 to 3 and 4 to 6 show somewhat similar conditions of malocclusion. The case shown in Figs. 1 to 3 relapsed after the removal of the appliances, while the case shown in Figs. 4 to 6 remained unchanged after the removal of the appliances. It is difficult to explain with certainty why the one case relapsed and the other remained unchanged.

The case shown in Fig. 7 is a type which frequently tends to relapse after complete treatment. However, after only partial and incomplete treatment, the result obtained in Fig. 8 remained unchanged two and one-half years after the removal of the appliances. Although a distinct malocclusion remained after the partial treatment, the results of the treatment were unaltered.

In maintaining arch relationship, the factor of growth and development must be considered. Changes are taking place in the jaws at adolescence due to growth and adjustment. This may cause a forward movement of the mandibular dental arch. This situation is particularly noticed in Class III cases, or those which have a tendency toward Class III. These cases may tend to relapse at the adolescent period, which in some instances, may be a considerable length of time after the removal of the retaining appliances. Figs. 9 to 11, taken from Hellman,

Fig. 1.

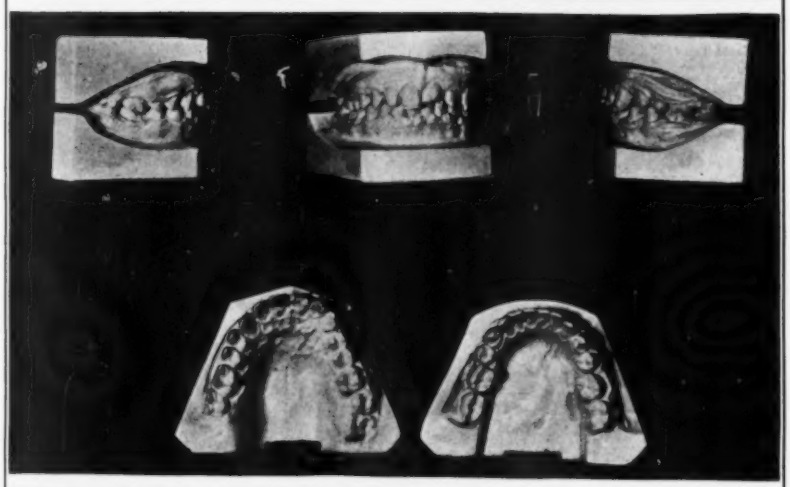

Fig. 2.

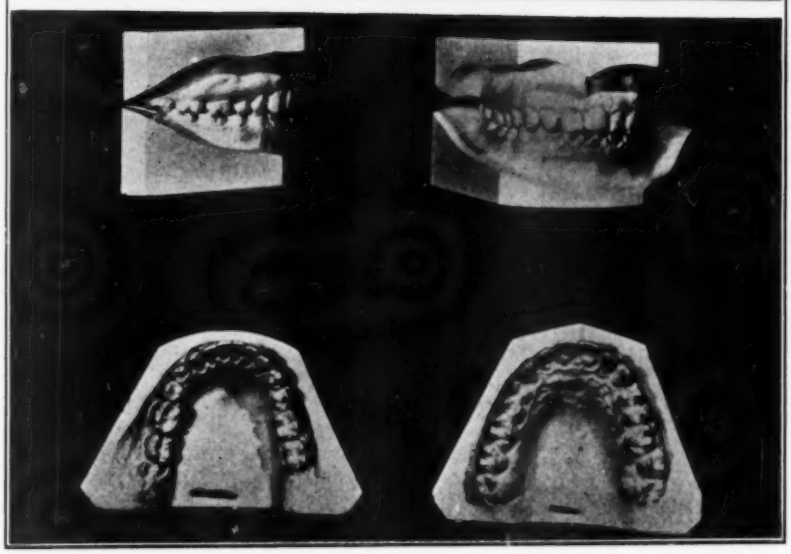

Fig. 3.

Fig. 1.—Casts of girl, aged sixteen years, Class II, Div. 1.

Fig. 2.—Casts of patient shown in Fig. 1 after two years of treatment and retention.

Fig. 3.—Casts of same patient, four and one-half years after removal of all appliances. There is a slight relapse, especially on the right side.

Fig. 4.

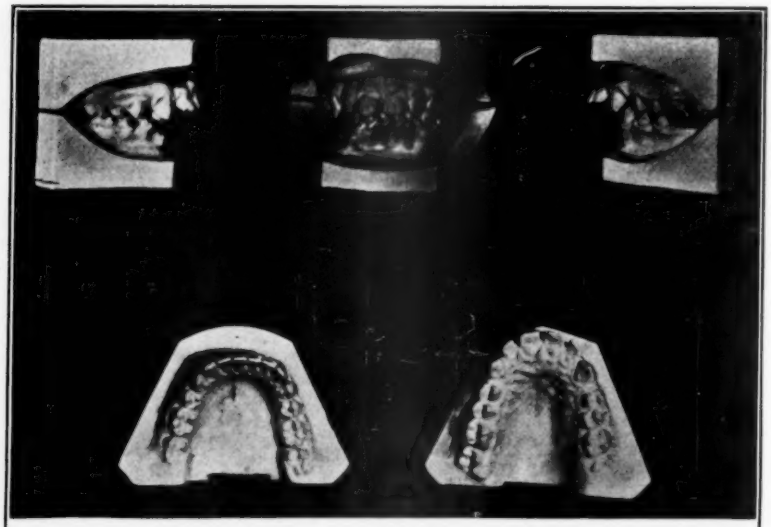

Fig. 5.

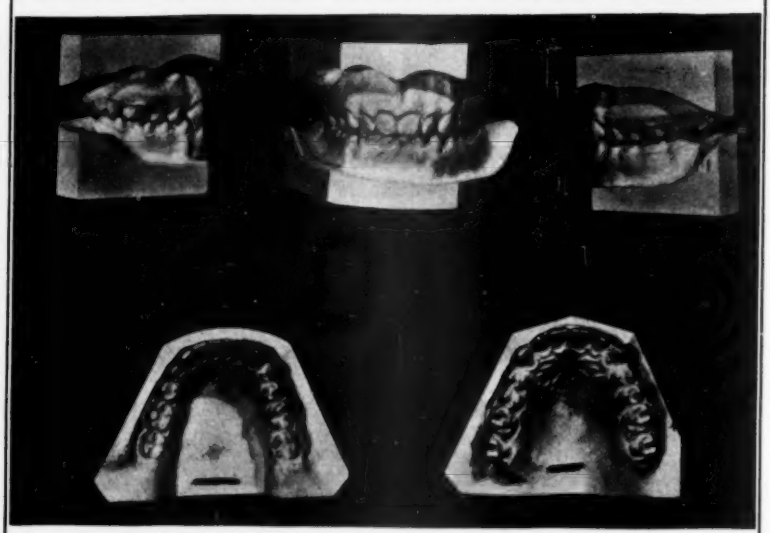

Fig. 6.

Fig. 4.—Casts of boy, aged twelve years. Class II, Div. 1, subdivision.

Fig. 5.—Casts of patient shown in Fig. 4, one and one-half years after treatment and retention.

Fig. 6.—Casts of same patient, one year after removal of all appliances, showing no further changes taking place.

illustrate this point very well. Hellman has suggested that Class III cases be retained after the adolescent spurt of growth has passed, in the hope that the result will remain permanent.

From the standpoint of positions of teeth, the case shown in Fig. 12 is more abnormal than the one shown in Fig. 9. However, one can readily appreciate that the factors operating in the case shown in Fig. 11 are quite different than those operating in the case shown in Fig. 14. An appreciation of conditions such as these is most important in considering the problem of retention.

The second factor recommended in the literature to be considered at the time of commencement of retention is the removal of conditions assumed to produce or influence the malocclusion. Upon thorough investigation, it has been shown that many causes of malocclusion are of such a complex nature and are so involved that they may not be readily recognizable and therefore their removal or mitigation cannot be accomplished. Where the causes can be ascertained and removed, it would assure greater success. This procedure should be instituted during treatment and not permitted to remain until the teeth have been arranged in their normal positions.

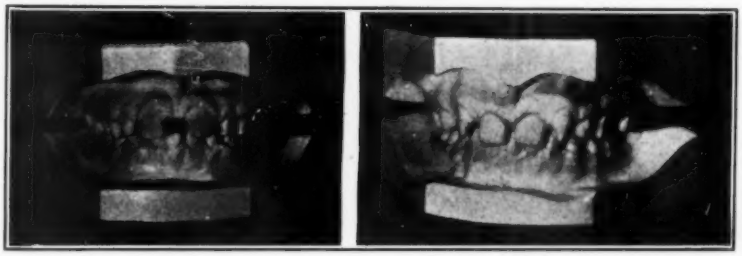

Fig. 7. Fig. 8.

Fig. 7.—Casts of boy, aged ten years, with congenitally missing maxillary lateral incisors. There is a marked protrusion and separation of the maxillary central incisors, and a deep overbite is present.

Fig. 8.—Casts of patient shown in Fig. 7, after four months of incomplete treatment. No changes took place after the removal of the appliances.

Most of the authors, with the exception of Mershon, recommend the placement of simple retaining appliances upon the completion of active treatment to prevent the teeth from returning to their original positions. These appliances may be in the form of bands with spurs attached or connected to other bands, or even an entire arch may be used. Removable appliances, as plates, are frequently recommended which permit greater function, which according to Oppenheim is ideal for this period. It is also recommended that these appliances be gradually dispensed with to assure better results.

Age as a factor to be considered during retention is stressed by some authors. They claim that the earlier a case is treated the shorter the period of retention. This does not always prove to be correct. If cases are treated at an early age, they should be kept under observation during the entire developmental period. During the period of the eruption of the second molar, growth with its attendant changes is taking place in the jaws. During the period of adolescence, further changes are taking place as the result of growth and adjustment. Therefore,

Fig. 9.

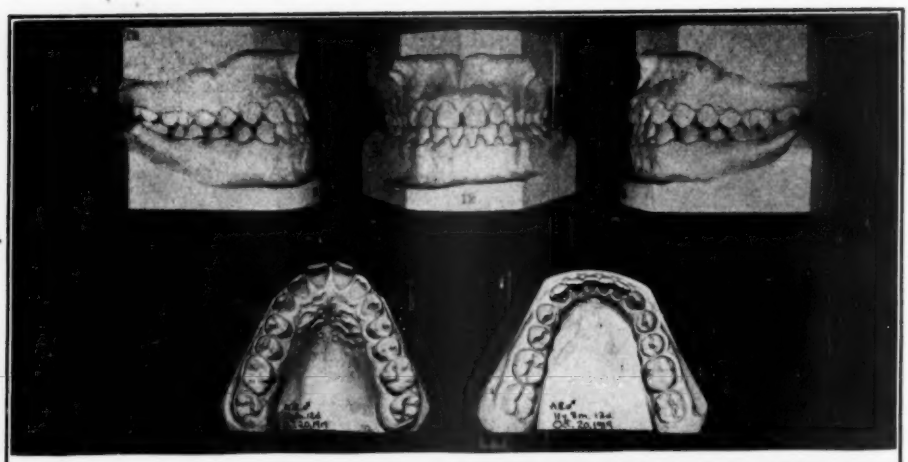

Fig. 10.

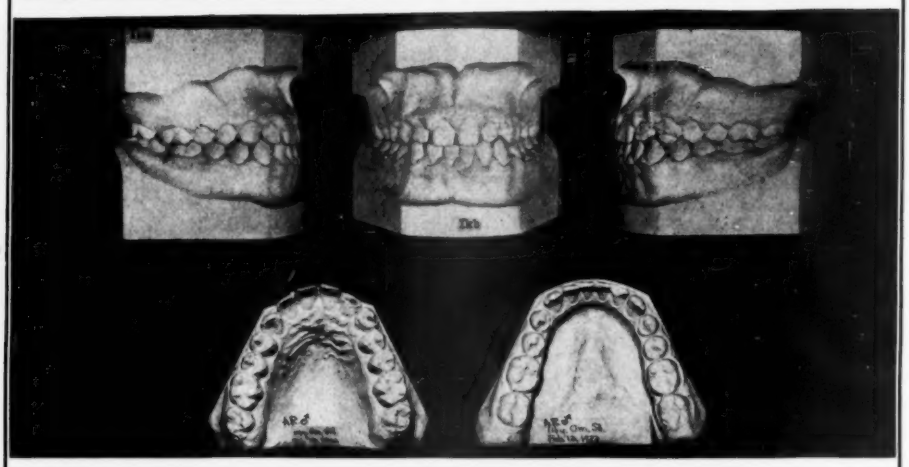

Fig. 11.

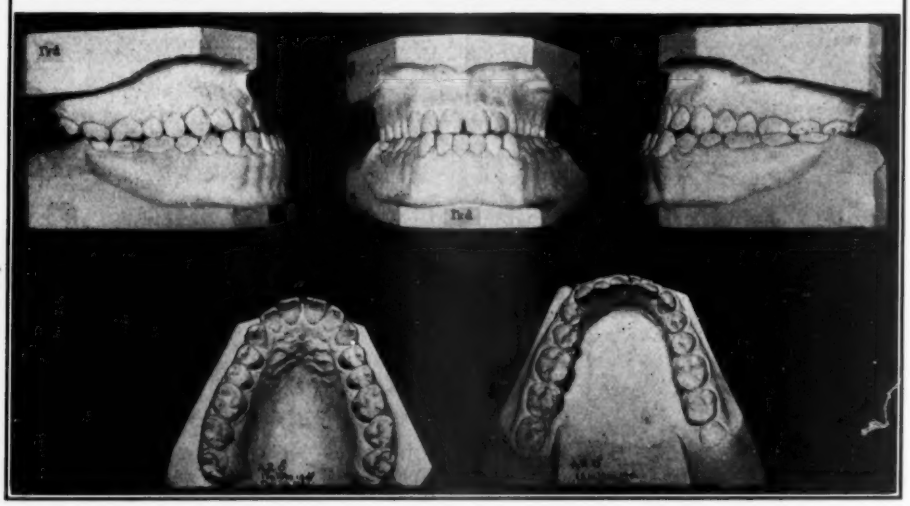

Fig. 9.—Casts of boy eleven years, eight months. Class I with tendency toward Class III.
Fig. 10.—Two years later, showing successful result of orthodontic treatment.
Fig. 11.—Five years later, showing condition brought about by growth changes subsequent to orthodontic treatment. (From Hellman.)

the effects of this growth may alter the changes accomplished during active treatment. If retaining appliances are in position during any of these periods, they may prevent the proper adaptation that should take place. On the other hand, they may be useful in preventing undesired movements of the teeth as the result of developmental changes.

Many authors recommend the application of myofunctional therapy during the period of retention. The purpose of these exercises is to strengthen weakened muscles and assure their proper functioning. While a great many men employ these measures, still some do not make use of them. Both groups obtain good results. Further scientific study should be carried on in this direction.

Last, the factors of promoting the general health and the health of the oral tissues are suggested by some as aid in retention. Many patients undergoing orthodontic treatment are not normal in general development and health. When these conditions are improved, there is no doubt that the improvement will serve as an aid in the successful completion of the treatment.

Disturbances of the function of the glands of internal secretion may have a direct bearing upon the success of orthodontic treatment. If and when undue growth stimulations emanate from these structures, the occlusion may be altered,

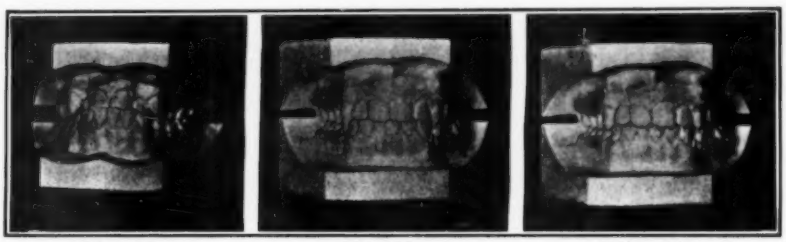

Fig. 12. Fig. 13. Fig. 14.

Fig. 12.—Casts of boy, aged thirteen years.
Fig. 13.—Casts of same patient shown in Fig. 12, after one year of treatment.
Fig. 14.—Casts of patient, two years after removal of all appliances.

irrespective of how perfect the result may have been, or how long the retention may have been applied. Howard has brought out this fact clearly, especially pertaining to Class III cases. This is why Hellman has recommended the retention of Class III cases past the adolescent spurt of growth, which varies with the sexes.

In summarizing the problem of retention, it may be stated that many authors in discussing the subject agree upon:

1. Certain changes of an histologic nature take place within the tissues supporting the teeth upon the cessation of active treatment. In view of this fact the impression is given, that a period of maintenance or of holding the moved teeth in their new positions for a period of time, is the main fact to be considered for permanent success. Some authors overlook the fact that the denture does not remain in a static condition and that it is subject to changes as a result of activity taking place within the individual.
2. An adaptative reaction of all tissues involved in tooth movement takes place following treatment.

3. In order to maintain the results obtained by orthodontic treatment, the teeth should be maintained in their new positions to prevent their return to their former places while the above changes are occurring.
4. It is implied by many that following a so-called period of retention of varying lengths of time with a possible reduction or simplification of the mechanical retaining apparatus, the result obtained will remain permanent. Unfortunately this latter condition does not always follow, as has been pointed out by some writers.

In conclusion it may be stated that a long period of observation should follow the removal of all appliances, especially until the active developmental periods have been completed, to ascertain ultimately the final results of the treatment. This latter period, with few exceptions, has been given little consideration in our literature. "This long period of postoperative observation will determine in the operator's opinion what he has or has not accomplished" (Hellman).

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CENTRAL MEDICAL BLDG.

MEDICAL PROBLEMS RELATING TO ORTHODONTIA

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HOW often do we form opinions of individuals before we even hear them speak, and frequently judge their characters by the expression about the mouth and facial outlines; therefore marked facial deformities cannot but have influence in shaping a child's or an adult's whole life, especially if he be supersensitive. It is then of the utmost importance to allow every child an opportunity to develop normally, mentally as well as physically, and under the most favorable conditions.

Orthodontics plays an important part in our health service, giving the child this opportunity to overcome such handicaps and aids him to become a useful and normally minded citizen. It deals primarily with the prevention of deformities and abnormal development of the dental arches and teeth, is directly associated with the internal and external growth of the face, and indirectly with the functions of the endocrine glands, nutrition, digestion and other related structures that deal with the development and health of the whole bodily system.

The arrest of growth and the disturbances of function of the internal and external face, which are associated with many cases of malocclusion, are but symptomatic expressions of the disturbances of balance and function; therefore malocclusion and irregularities in the position of the teeth may be considered the objective symptom of abnormal development and the consequent arrest or deficiency of growth.

In presenting today the subject of "The Medical Problems Relating to Orthodontia" I am immediately confronted with what may be termed a "triple alliance," for the audience is composed of physicians, dentists and orthodontists. As a result, one becomes apprehensive about the varied interests in the subject. The physician may or may not have heard of such a word as orthodontia, and if so he may be confused as to its intent and purpose. The dentist, on the other hand, was compelled in his undergraduate days to "play" with it and thus obtained some knowledge, much of which is erroneous today, while the orthodontist's interest will be somewhat lessened by a repetition of facts he already knows. It thus becomes a problem of divers interests and, in the brief time allotted to me, I shall confine my remarks to general statements and consider only those subjects suggested by the Chairman.

DEFINITION OF ORTHODONTIA: AS FIRST GIVEN AND AS NOW CONSIDERED

Let me begin by presenting the word orthodontia as it was first defined and as it is interpreted today; in this manner, we shall all have a clear understanding of the subject under consideration. It was in 1900 that Dr. Edward H. Angle defined orthodontia as "that science which has for its object the correc-

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tion of malocclusion of the teeth.''[1] By 1927 the scope of the field embraced and the problems confronting the orthodontist had so changed that McCoy proposed the following: ''Orthodontia is a study of dental and oral development; it seeks to determine the factors which control growth processes to the end that a normal functional and anatomical relationship of these parts may be realized, and aims to learn the influences necessary to maintain such conditions when once established.''[2]

Instead of merely moving teeth, orthodontia has now become a biologic problem with many interests.

There are other definitions but the above will suffice to acquaint those present with the meaning of orthodontia and its use in this paper, as well as illustrate the changes that have occurred in the short span of thirty-odd years and the understanding and interpretation of the science. Unfortunately this change is not apparent to all, as can best be judged by the latest definition found in a dental dictionary.[3] Here we once more find the meaning to be: ''The correction of dental irregularities by the movement of malposed teeth to correct positions; the art and science of the treatment of malocclusion,'' treatment again taking the place of science.

Prior to 1900, few members devoted their full time and efforts to this particular field of endeavor. Principles of appliances and of treatment were considered of the utmost importance in the practical application of the science, overshadowing the appreciation for a fuller knowledge of cause and effect. The years have developed a broader concept. Originally we were satisfied with a study of the teeth and their supporting tissues; we now desire to know more concerning the growth of the body and the development of its parts to and through the ideal of functional perfection. The dental and oral structures cannot be segregated as something apart; they must be considered as a part of the bodily system as a whole. Orthodontia is today the result of the efforts during the past thirty years of that determined group of men who realized the inadequacy of their knowledge and strove to correct that situation.

Moving the teeth from one position to another is a minor problem in a vastly different science of orthodontia. Whether the biologic concept is the whole story, I shall not enter into at this time; it is sufficiently established, however, to justify present-day orthodontic procedure.

IS ORTHODONTIA A RECENT PROBLEM?

That we are dealing with new problems, generally believed to be the result of modified conditions brought about through modern civilization, is not a fact, for ancient Man, physically in some respects, was very much as man is today.[4] There is sufficient evidence to show that he suffered from caries as well as abnormalities in the position and irregularities of the teeth, and that unerupted, supernumerary, retained and impacted teeth date back to the earliest remains of the human type. The Neanderthal Man, 40,000 to 60,000 years ago, is perhaps the most interesting to us of these ancient remains. (Fig. 1.) In one skull found at Le Moustier, we find a retained left deciduous canine with an un-

erupted permanent canine below it.[5] The roentgenograms show this tooth as well as an unerupted third molar. There is likewise every indication that

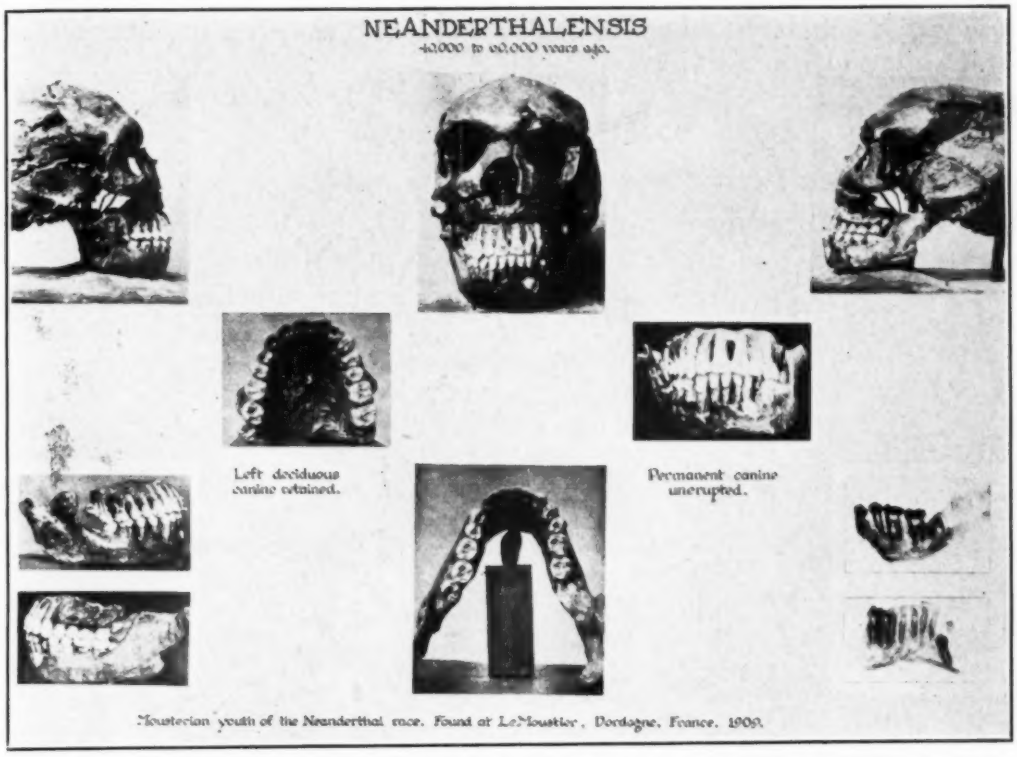

Fig. 1.—Prehistoric man—Neanderthal, in which there is a retained deciduous left mandibular canine still present with an unerupted left permanent canine within the process; likewise an impacted mandibular left third molar.

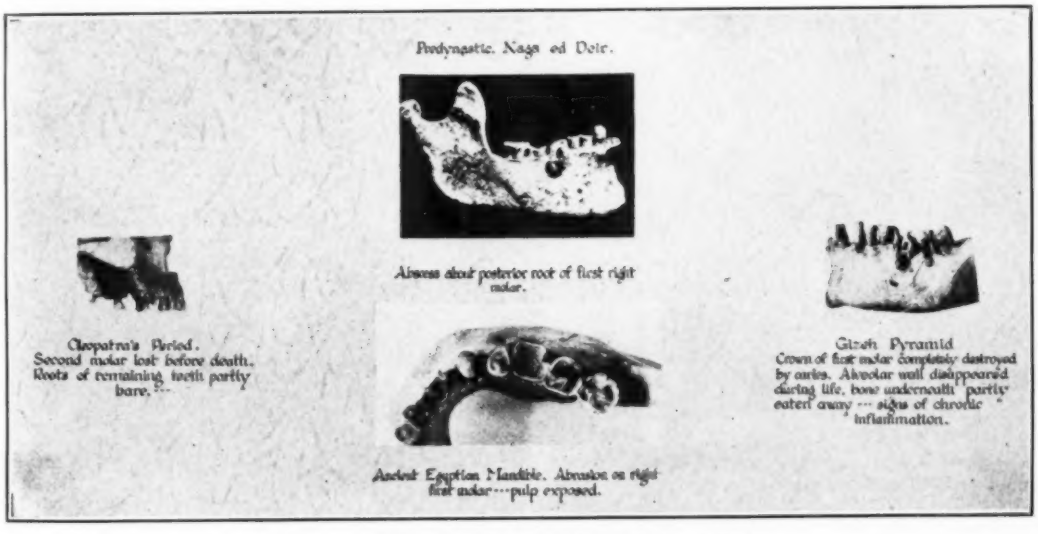

Fig. 2.—Typical Predynastic Egyptian skull.

primitive man's incisor occlusion was an edge-to-edge relation, a condition I noticed so prevalent in the group I examined for the draft during the World War.

Fig. 2 shows a skull dating from Predynastic Egypt showing large abscess areas, abrasion on right first molar with pulp exposed. Coming to the New World, there are such examples as those found among the ancient Peruvians, one with a cuspid erupting from the zygomatic process of the maxilla, another with a malposition of a wisdom tooth (Fig. 3).

The condition of the teeth in Rhodesian Man as well as that of the teeth of Predynastic Egyptian must be astonishing to those who are inclined to believe

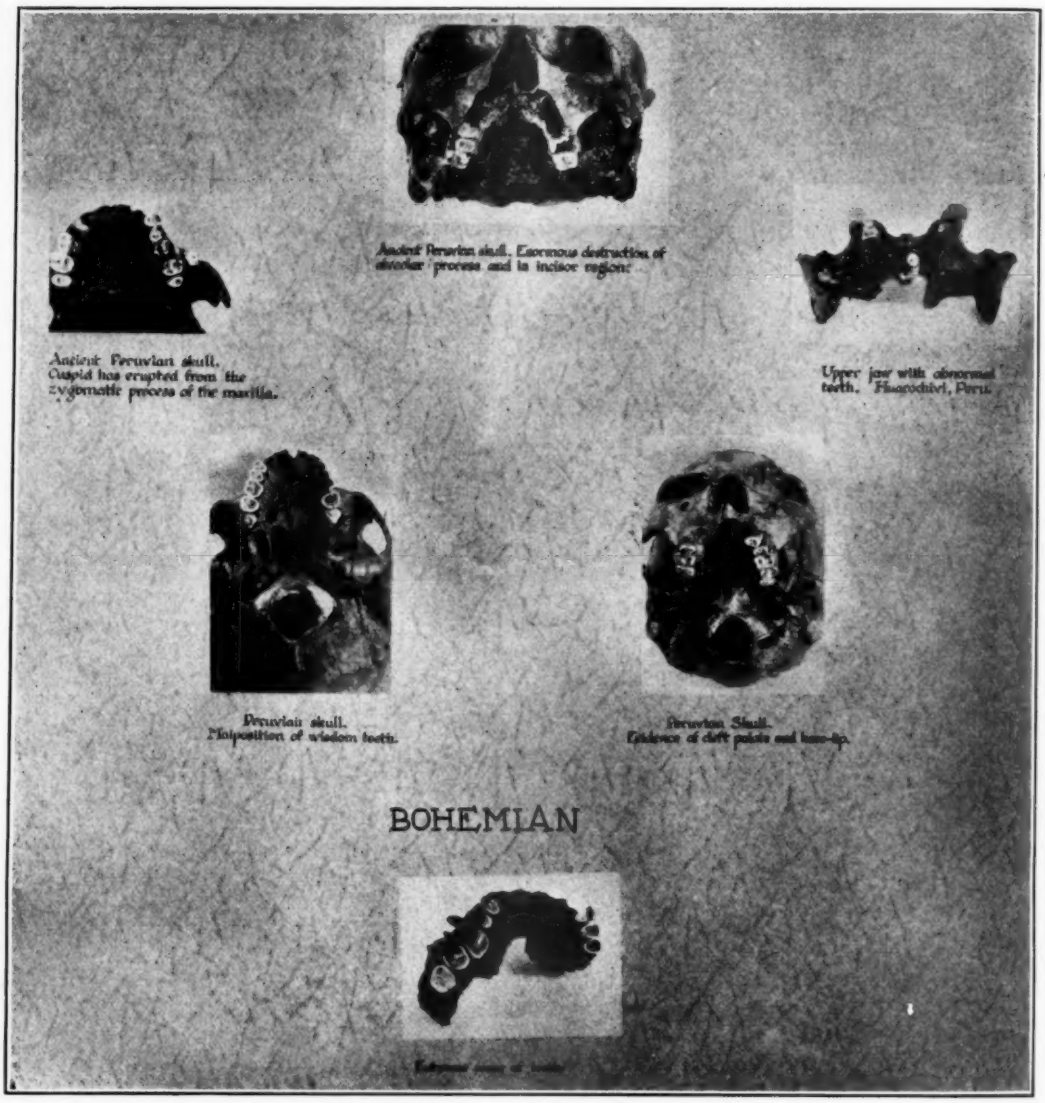

Fig. 3.—Ancient Peruvian skulls with malposition of third molars and cuspid erupting from the zygomatic process of the maxilla. Thus dental conditions confronting the orthodontist do not differ from those of ancient man.

and maintain that caries is something entirely modern, while those who state that we are going through a stage of reduction in size of teeth as well as in number, have only to glance at these same illustrations to find that such a theory is likewise incorrect. Therefore for the present we must content ourselves with and accept the idea that modern man's dental apparatus has not changed since the dawn of Man.

BRIEF HISTORY ON DEVELOPMENT OF ORTHODONTIA AS A SPECIAL BRANCH OF DENTISTRY

Since we find that modern civilization has not brought about a changed condition in man's dentition, just when did he begin to interest himself in the position of his teeth and means for their correction? It is interesting to note that observations regarding the position of the teeth and means for their correction were made before the present era, and that many of our theories and ideas relative to cause are as old as irregularities themselves and that we still cling to any number of them. There is that interesting passage recorded in the works of Hippocrates (460-377 B.C.) in which he observed that "among those individuals whose heads are long shaped, some have thick necks, strong members and bones; others have strongly arched palates, thus teeth are disposed irregularly, crowding one on the other. . . ." and going back to Celsus (25 B.C.-A.D. 50) we find the first method of treatment. The first appliance used to correct these conditions is to be found in the work of Albucasis (936-1013), so that one can readily see that we are not considering, by any means, a problem that is new.

The basis of our present-day treatment is the expansion arch, and for this important step in the history of regulating appliances, we are indebted to the "father of dentistry," Pierre Fauchard (1678-1761). Without doubt its introduction marks the most important phase in treatment, and although it seems crude because of its bulk, nevertheless the mechanical principles of the expansion arch are the same today as they were in 1728. Its chief function was to widen the dental arch and to bring those teeth in irregular places to their correct position.

From the time of Hippocrates, one thus sees that certain defects, which repeatedly occur in the human dentition, were observed and attempts made to correct them; these consisted chiefly in irregularity in the position of the teeth, malshaped dental arches, arched palates and the consequent disturbances in relation of either the teeth themselves or of both the teeth and the dental arches of the two jaws.

Though the word orthodontia was introduced into the profession in 1841,[6] until the early part of the Twentieth Century, it was generally considered merely correcting the irregularities in the teeth, and so it was generally spoken of until a new significance was given to this field of dentistry. Until then it was but a problem of appliances and the solution was quite simple, merely recognizing that there were certain defects which are alterable, and changing these through the application of mechanical devices, specially designed and constructed for the purpose. Of the many developed, gradually there appeared two types that won general favor, and became known as the Angle and Jackson "systems of appliances." (Fig. 4.) The Angle system consisted of expansion arches, molar and plain bands, ligatures and minor accessories; while the Jackson system was a perfected "crib" originated by Delabarre (1819) and a modification of the W-shaped wire as used by Coffin (1887). Between these two extremes, many other so-called systems or methods have appeared, but they cannot be considered as independent manifestations, for they lean toward either the one or the other appliance. There must be added a further difference; the

Angle system was a simplified systematic course of procedure, involving mainly the principles of treatment as based upon the Angle classification of malocclusion, while the Jackson system consisted of a mechanical training in the making

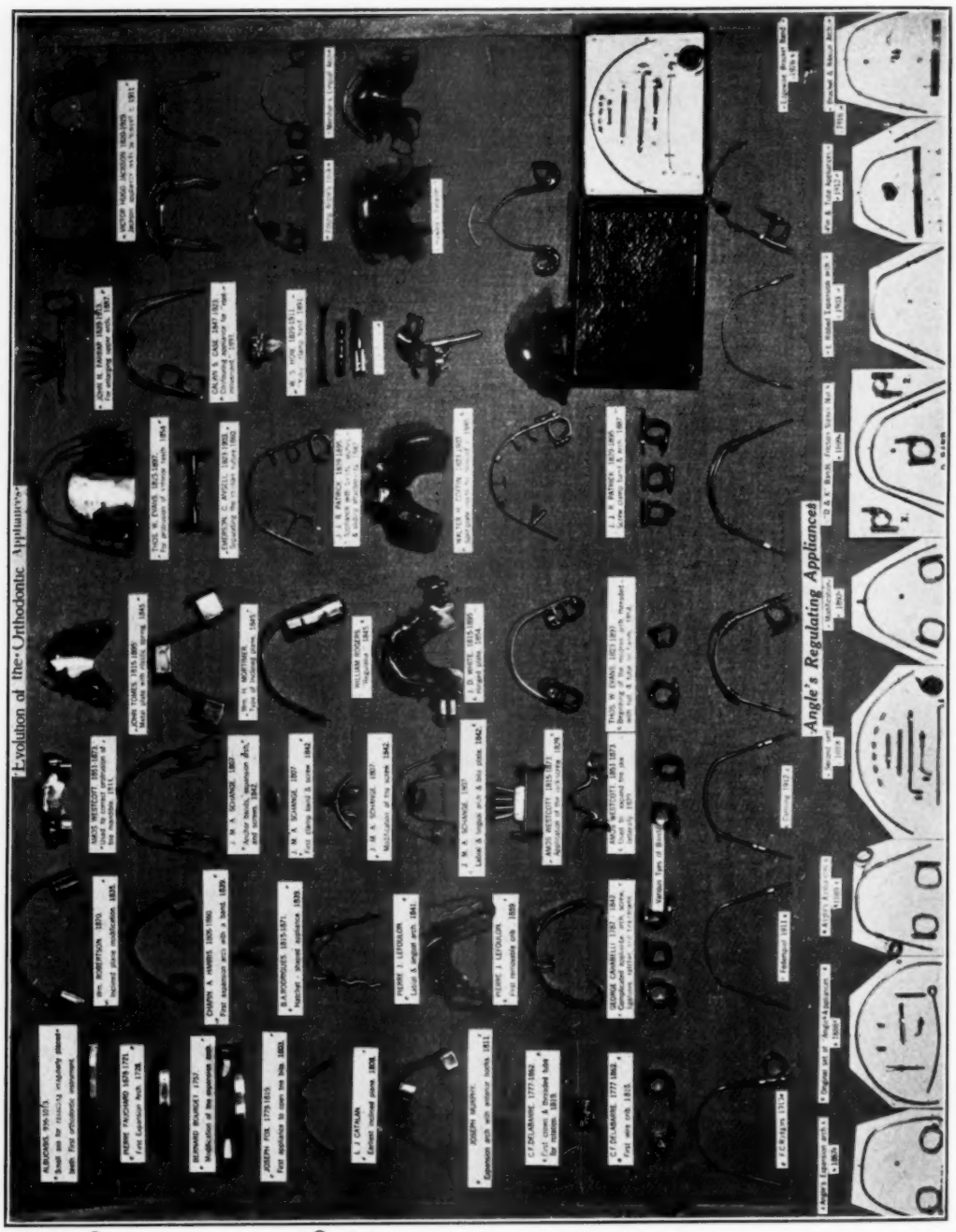

Fig. 4.—Of the many "systems" developed in orthodontia, there appeared two types that won general favor and became known as the "Angle and Jackson" systems of appliances. All other systems lean toward one or the other and are but a modification of some part.

of appliances for a great variety of forms of individual manifestations of occlusal deviations. Thus while the former aims at general systematic order

and arrangement, with a view to facilitating educational methods, the latter manifests a traditional attitude of individual instruction and specific application.

About the year 1900, Angle likewise realized that if there was to be something to orthodontia, a complete change in this branch of dentistry would have to be brought about. He found that with the educational system then in our dental schools, the type of student he desired could not be produced. Every dentist was then trying to "straighten teeth" either by buying stock appliances from the dental depot or, for those who found this too much trouble, an impression could be taken of the patient's teeth and the laboratory would construct an appliance on the cast. With the introduction of specialization, a gradual change was brought about, and by 1915 very few dentists found it advisable to do this work and practice the dentistry which likewise had changed. Today, either because of the present economic situation or because many believe the field the easiest to practice as well as the most lucrative, things have again reverted to the situation which existed in 1900. There are now about 65,000 dentists in the United States, and about 30,000 are "straightening teeth" with the aid of dental laboratories. You will note that I am careful to state "straightening teeth" in contradistinction to orthodontia. Here is one of the great problems of practice that you will have to face and fight if you are interested in the progress, in the ethics of the profession and the welfare of your patients.

Realizing the danger of indiscriminate use of appliances by the uninformed or the incompetent, Angle desired to improve the skill of those sufficiently interested to make it their life's work, and began to make a specialty within the dental profession. Like Chapin A. Harris, in 1840, Angle desired a secure foundation based upon three things; first, a postgraduate school in order to instruct future adherents, second, a society "as a forum of exchange of knowledge and fraternal intercourse"; and, third, a journal, so that the knowledge acquired might be disseminated and the specialty stimulated. The Angle School was therefore established in 1900 to train specialists and became known and was distinguished for many contributions. Dr. Angle soon built up a well-organized center in orthodontia. The number of students grew large, and many are the orthodontists now scattered far and wide in various parts of the world who received instruction from him and inspiration for the advancement of orthodontia. One of the most outstanding contributions which merits special mention was the introduction and practical application of the concept of normal occlusion as it related to the human dentition. This idea became the basic foundation for orthodontic operation and furnished the starting point for its practice. In orthodontia it brought about a standard by which all shortcomings in dentition were to be measured, while in dentistry it served as an explanation of the functional aspect of the masticatory apparatus.

NORMAL AND IDEAL OCCLUSION

As occlusion is the basis of the science of orthodontia, I shall endeavor to explain what it means. The generally accepted definition is that occlusion is "the normal relations of the occlusal inclined planes of the teeth when the jaws

are closed.'"[1] Fig. 5 illustrates this relation. In order to be normal, the human dentition must consist of all 32 teeth, each normal in form, in their proper position, even in alignment and with the mandibular first molars slightly in advance of the maxillary, causing all the teeth anterior to it to bear this same relation. Any deviation from this normal would be malocclusion. Angle assumed that

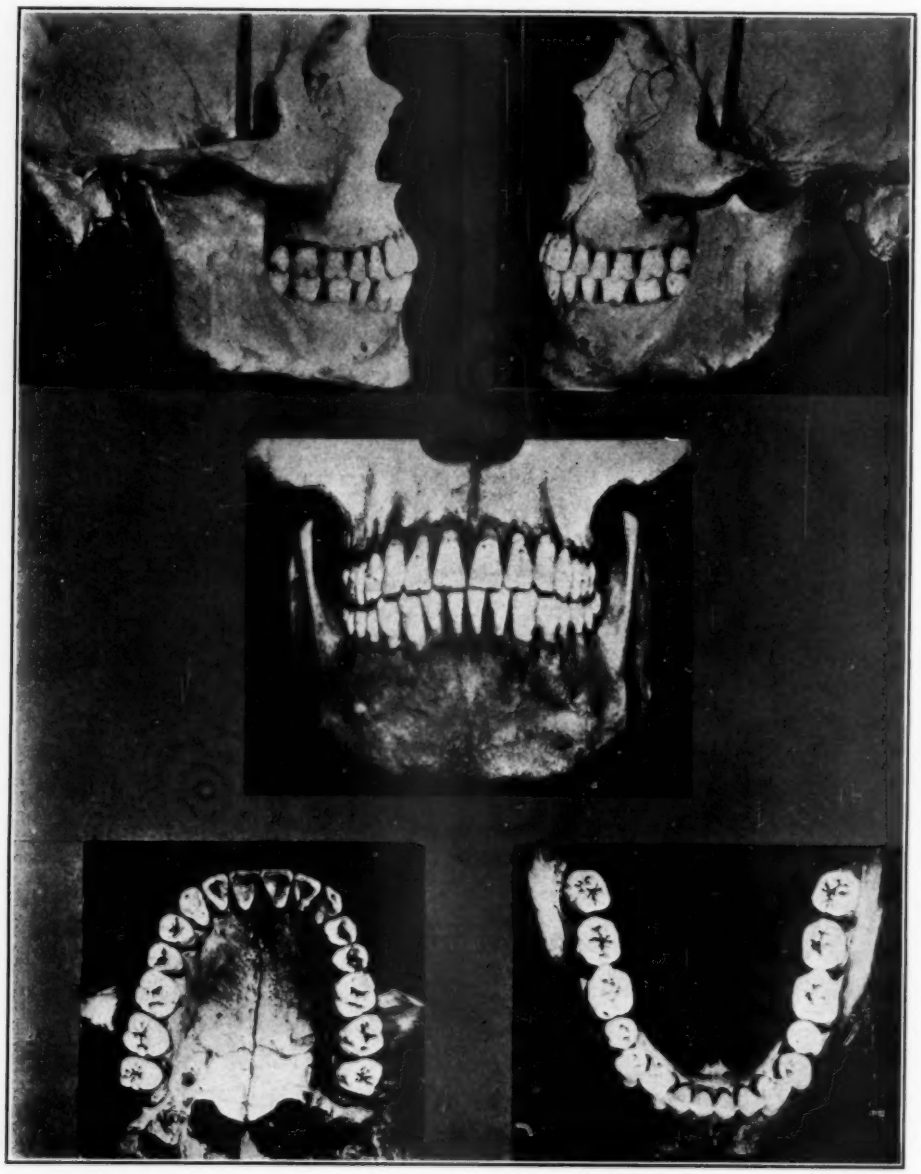

Fig. 5.—Skull with an "ideal," formerly called "normal" occlusion. Nearly all the skulls so far presented show but one side, the other having some sort of irregularity present. (Property of the author.)

the maxillary first molars were the least liable to change;[7] in other words, were the most constant in their eruption, and using this idea, he brought forth a classification.[8] This classification did more to advance and simplify orthodontia than any step we know. The fundamental idea is that "classes are to be based

on the mesial distal relations of the teeth, dental arches and jaws, which depend primarily upon the positions mesiodistally assumed by the first permanent molars on their erupting and locking.'' Thus he divided all occlusal manifestations into three classes; because of its simplicity and despite various criticisms and the new classification at various times suggested, this has since 1899 become the acknowledged classification. Fig. 6 explains these differences.

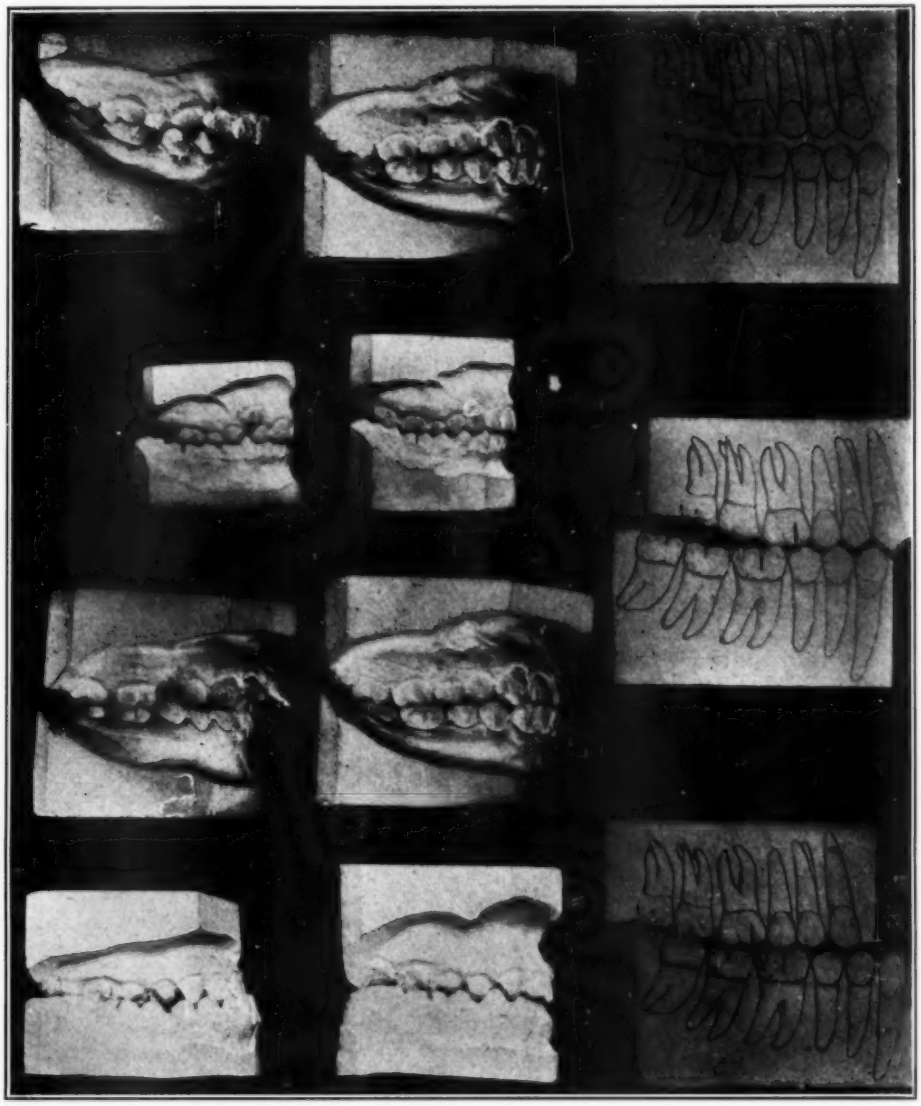

Fig. 6.—Three main types of typical malocclusion:
Class I (neutroclusion).
Class II (distoclusion).
Class III (mesioclusion).
Left-hand figures, original conditions; center grouping, corrected state with the first molars in their correct relation. Outline drawing of each type.

The idea of normal occlusion as given by Angle, remained the yardstick of the specialists for many years. It made them seek perfection in their work, but perfection in the human being is so seldom seen that Hellman,[9] later recognizing this, called to our attention that what we had assumed to be a ''normal''

was but an "ideal" and that there was an "average" with which we had to deal. With this "average" and "ideal," normal occlusion took on a new conception. The recognition and promulgation of the principles of normal occlusion, however, proved to be of the greatest importance in establishing orthodontia as a specialty, and among the early specialists the ideal is still the goal they seek.

PREVALENCE

No one who practices dentistry has the slightest doubt of the great prevalence of malocclusion, this being so obvious that little attempt has been made to obtain definite statistical proof.

In considering normal occlusion we have just mentioned the difference between the normal and the ideal, for in the various large collections of skulls in museums and institutions there are but few that can show a correct relationship of the jaws and have perfect alignment of teeth.

At first it was thought that malocclusion was brought about as the permanent teeth came into their position and that such conditions could not be found in the deciduous set. In 1916, however, I introduced into orthodontic literature the question of antenatal variations in the relation of the jaws,[10] this paper being followed by two others in 1918[11] and 1922.[12] Among the many problems then considered was the one of a variation in the relation of the jaws in full-term fetuses and newborn children, that at birth we had the three types of cases, those with a normal relation, another with the jaw displaced backward and the third with the mandible protruding and a corresponding change of the angle of the mandible; that these conditions, as the child developed, became progressively worse. Miss Lilah Clinch of London, in 1931,[13] in a study of 400 infants at birth, has confirmed this, for at this early period of life she has found the relation of the jaws to be a threefold variety of types. In the cases examined, however, she did not find any with the mandible protruding. The first type, with the jaws normal in their relation, was 70 per cent of those she examined; of the two other types there were malrelations to the extent of 30 per cent. It is thus clearly shown that beginning at birth, before any teeth are present at all, there is a definite malrelation of the jaws to the extent of 30 per cent (Tables I, II, and III).

As to the incident of malocclusion in the permanent dentition, in 1923 Sir Arthur Keith estimated the percentage to be one-third of the population. In 1924, of 20 London hospital students, it was 50 per cent; of 50 modern British skulls, 26 per cent; of 25 skulls in the Army collection, 25 per cent. Again in 1925, on deformed and reduced skulls, 20 to 25 per cent. Keith came to the conclusion that at least 25 per cent of England's population showed irregularities of the teeth and malocclusion.[14] Chiavaro,[15] in Rome, Italy, reports 28 per cent. Friel[16] in Vienna after the war, found that out of 521 children ranging in age from one to fourteen years there was 35 per cent, while Strandberg[17] in Stockholm in 2,296 children, seven to nine years, found a percentage of 23.17 with malocclusion.

Thus we find that in different racial and local groups throughout the world, likewise in the lower mammals, and extending back to earliest man, there is no group that escapes this condition.

TABLE I*

RATIO OF THE NORMAL AND ABNORMAL IN OCCLUSION OF THE TEETH IN VARIOUS RACES

RACE	MALE			FEMALE		
	TOTAL NO.	NORMAL OCCL.	PER CENT NORMAL	TOTAL NO.	NORMAL OCCL.	PER CENT NORMAL
Ancient Amerind	16	15	93.75	5	1	20.00
Modern Amerind	21	18	85.71	14	13	92.85
Eskimo	14	7	50.00	--	--	----
Hindu	20	14	70.00	19	11	57.84
Japanese	12	4	33.33	3	2	66.67
Mongol (Borneo Chinese)	9	3	33.33	5	1	20.00
Mongol (Buriat)	15	11	73.33	17	16	94.12
Tasmanian	7	5	71.43	4	3	75.00
Australian	8	7	87.50	6	3	50.00
Negro (East African)	26	19	73.08	7	7	100.00
Negro (South African)	10	10	100.00	--	--	----
Negro (West African)	50	34	68.00	26	17	65.38
Negro (W. R. U.)	43	40	93.02	--	--	----
White (Salzburg)	5	0	00.00	--	--	----
White (Carinthian)	6	2	33.33	1	0	00.00
White (W. R. U.)	62	42	67.74	4	2	50.00
White (Demko-Hegy)	16	11	68.75	25	16	64.00
White (Keszo Hidegkut)	58	36	62.07	50	24	48.00
White (Szarazd)	29	18	62.07	13	10	76.92

TABLE II*

COMPARISON OF THE NUMBERS IN TYPE 1 (SUBCLASSES A AND B), TYPE 2 (SUBCLASSES A AND B) AND TYPE 3 (CLINCH)

	A (WITH SPACE)	B (WITHOUT SPACE)	TOTAL
Type 1	204 (73%)	76 (26%)	280 or 70%
Type 2	46 (42%)	62 (58%)	108 or 27%
Type 3		12	12 or 3%
	250	150	400

TABLE III*

COMPARISON OF THE NORMAL AND ABNORMAL IN OCCLUSION EXPRESSED IN PERCENTAGE

AGE	BOYS			GIRLS		
	NO.	NORMAL	ABNORMAL	NO.	NORMAL	ABNORMAL
5	15	68.75	31.25	17	70.58	29.42
6	32	30.31	69.69	33	39.39	60.61
7	64	18.75	81.25	41	29.26	70.74
8	76	25.97	74.03	47	19.15	80.85
9	88	17.04	82.96	54	27.77	72.23
10	72	16.66	83.34	49	30.61	69.39
11	68	27.94	72.06	51	37.25	62.75
12	72	31.91	68.19	43	30.23	69.77
13	45	33.33	66.67	40	32.50	67.50
14	36	30.55	69.45	33	36.36	63.64
15	25	38.46	61.54	12	41.66	58.34

In the United States, various reports indicate a slightly higher percentage. In 1924 an examination by Dr. C. Mebane[18] of 3,000 school children of Olmstead County, Minnesota, showed a percentage of 59.

*Tables I-III, From Hellman's discussion, INTERNATIONAL JOURNAL OF ORTHODONTIA AND DENTISTRY FOR CHILDREN 21: 1110, 1935.

Hellman has given this problem considerable attention and has brought forth many interesting conclusions. In 1920, examining 1,200 children of the same racial group as found in one of the orphan asylums, he found then a percentage of 39 having malocclusion.[9] The incidence of malocclusion as it appeared in their dentition is shown in Table III. He calls attention to two interesting points: "The one is that the incident of malocclusion is considerably lower than has been assumed, and that the other is that it changes with age as shown in Table III. As the children grow older and begin to lose their deciduous teeth, malocclusion increases up to 83 per cent in boys at 10 and 80 per cent in girls at 8, while at five years, when the deciduous dentition is still intact, malocclusion appears to the extent of 31 per cent in boys and 30 per cent in girls." We find here a gradual increase in the incident of malocclusion up to 8 years in girls and 10 years in boys. It then decreases again until at the age of 15, when the permanent teeth replace the deciduous.

In another examination of 217 students at Columbia, Hellman found the incident of malocclusion reached 69 per cent.[19] Therefore beginning with birth, there has been observed an incident in malocclusion of the teeth of 30 per cent and that during the first ten years, this incident increases to 83 per cent in boys and 80 per cent in girls, and that with college students it has decreased to 69 per cent, so that the prevalence of malocclusion in the adult is pretty high.

AGE TO BEGIN ORTHODONTIC TREATMENT

At this point, let us consider at what age orthodontic treatment should be undertaken. When it was thought that malocclusion occurred only in the permanent dentition, students and the profession were advised to wait before beginning treatment until those teeth had fully erupted. Today, unfortunately, this advice is still adhered to by many dentists and such a procedure recommended. Later it was found that the deciduous teeth could be irregular and the time of treatment was carried back even as early as three years of age. When we discovered that early treatment did not bring about the desired results, when failures persisted, teeth again overlapped and when the reestablished relation of the jaws did not remain where placed, we began to restudy the problem. Though some continued to believe it was but a question of not having placed the teeth in their proper position (the mechanical idea still prevailing), and that the case had not been properly surveyed, others saw that mechanics alone was not sufficient in treatment and that some factor or factors, physiologic or biologic, were involved.

The more this question was studied, the more convinced we were of the truth of this presumption. With the knowledge that the incident of malocclusion varies with age, the greatest being between 5 and 10 years, and that in individuals, girls and boys, it is not the same for corresponding years, and that many cases if given an opportunity will correct themselves, especially if the two jaws are in their correct relation, today we have a better understanding as to when to begin treatment. Often in beginning treatment too early, Nature's own method of correcting her faults is interfered with, and greater damage thus results. The problem as to the age of correction therefore depends upon many factors and not merely that teeth are irregular. Experience plus a careful study

of each individual, giving consideration to the growth and development of the body as a whole, aided by roentgenograms; possible endocrine disturbances; prevailing habits, etc., must be the determining factor before an opinion can honestly be given. If marked early deformities occur, dividing the treatment into periods, it is advisable to correct those defects that are liable to bring about greater problems. Nature thus has an opportunity to do her part and will often do so far better than we. Often it is advisable to place cases under observation so that a study of the individual may be made and data thus obtained, greatly aiding in the method of treatment if required.

ETIOLOGY

I have previously called to attention that today, as it was some forty years ago, there are still two groups who are practicing this branch of dentistry, the true specialist who really is endeavoring to practice orthodontia as it should

OUTLINE OF THE ETIOLOGY OF MALOCCLUSION

PREDISPOSING CAUSES	DETERMINING CAUSES	
	LOCAL CAUSES ATTENDING DEFORMATIONS	
Acute and Chronic Infection and Deficiency Diseases.	Abnormal Frenum Labium.	Anomalies of Number.
Acquired.	Adenoids and Tonsils.	Contraction of Jaw.
Congenital and Hereditary Defects.	Cysts.	Disproportion and Size of Teeth and Jaws.
Constitutional—Children's Diseases, Syphilis, Rickets, Scurvy.	Family Traits.	Early Eruption of Deciduous Teeth.
Embryonic Defects.	Feeding, Soft Foods.	Excess Number of Teeth.
Endocrine unbalance.	Habits.	Germs of Teeth, Position of.
Environment.	Mouth Breathing.	Grinding Teeth.
Faulty Development—Hare-Lip and Cleft Palate.	Neurotics.	Imperfect Fillings and Dental Restorations.
Metabolic Disturbances.	Nutrition.	Jaws of One Parent and Teeth of Another.
Prenatal Abnormalities.	Obstruction of Nose, Nasal—Pharynx, and Throat.	Large Teeth.
Unknown Causes.	Pressure, Abnormal Muscular.	Loss of Teeth.
	Pressure, Intra-Uterine.	Malformed Teeth.
	Pressure, Malfunctioning Muscles.	Missing Teeth.
	Pressure, Sleeping Habits.	Neglect of Supervision of Second Dentition.
	Tongue, Abnormal.	Non-Absorption of Roots.
	Tonsils.	Non-Development of Teeth.
	Thumb-sucking.	Premature Shedding of Deciduous Teeth.
	Tumors.	Prolonged Retention of Deciduous Teeth.
		Reduced Size of Teeth.
		Supernumerary Teeth.
		Tardy Eruption of Permanent Teeth.
		Transposed Teeth.
		Want of Space.

Chart 1.—Outline of the etiology of malocclusion, grouped according to predisposing and determining causes. The latter separated into a group of outside influences and the third those dealing with the teeth.

be, and that vast number engaged in "straightening teeth" who regard orthodontic treatment in the light of a pure mechanical procedure, where etiology is relegated to a position of secondary or no importance and where the greatest

amount of effort and thought are given to the correction of conditions and little to its cause. Even when the most careful treatment has been carried out, failure results, not because of lack of mechanical ingenuity, but because of the causative factor either unknown or not understood. A general knowledge of the growth of an individual and his variation is so essential to an understanding of the causes of malocclusion.

The physician appreciates that all parts of the body are subject to abnormalities of development from one cause or another, and that as the dental structures are but a small part of the body as a whole, there is no exception here. One cannot overlook the fact that the dental apparatus is not a single organ without function; instead it is a very complex one, with many functions into which enter the teeth, dental arches, important groups of muscles, tongue, nasal passages, throat and accessory sinuses. These structures are so closely related that any disturbance in function, nutrition, metabolism and endocrines may affect one or involve the whole apparatus. Irrespective of what the cause might be, anything which interferes with the development of one or more of its parts or with the tissues composing them, must reflect in a varying degree of intensity upon the eruption of teeth or developing occlusion.

While in medicine a diagnosis is generally associated with a pathologic condition, and from symptoms or experience in a similar disease a physician can thus determine what is wrong, in orthodontia, which seldom involves such lesions, there are more involved problems closely associated with the growth and the development of the body. A glance at Chart 1 of recorded etiologic factors that have been advanced as producing malocclusion will briefly present this problem.

From this, it can be seen that practically every phase imaginable has been discussed. In 1931, J. C. Brash, thoroughly reviewed the entire subject, and the results of his studies indicate that "most of the conclusions at which we have now arrived seem to be negative."[14] In other words, we have as yet made but little progress during the centuries in our etiologic studies, for today we are as much in the dark as ever. These old theories are not sufficient, and a more general knowledge of the growth of the individual and how he is affected by various factors is essential. Here you can be of the greatest aid to us.

I shall not go into the details of these theories but will illustrate a few of the more common errors so often heard; for instance, we constantly hear that adenoids, tonsils and thumb-sucking produce irregularities of the teeth. Some of the worst thumb-suckers have the finest dental arches and occlusion, while many not having enlarged tonsils or adenoids and some who never were thumb-suckers have the most aggravated conditions. There is absolutely no correlation between the two. And speaking of the latter group, there appear to be two types of thumb-suckers, the one who acquires it after birth and the one born as such. Those who acquire it can readily be broken of the habit but not so with the latter.

TEACHING OF ORTHODONTIA

Prior to the introduction of the Angle School of Orthodontia in 1900, whatever instruction was given was that found in the under-graduate curriculum in our dental colleges. In 1900, postgraduate courses were established, first

by Dr. Angle and later by some of his students. The first Angle School continued until 1913, when Dr. Angle moved to California and established in 1924 the Angle College; shortly before his death in 1930, this course was transferred to the University of California. In 1913, Dr. Dewey, a pupil and a teacher in the Angle School, opened his school. During this period, several of Dr. Angle's pupils began to have assistants in their offices, teaching them the practical side of the specialty, and such institutions as the Forsyth Clinic, Harvard, Michigan and Pennsylvania, with a few private so-called schools, began to give postgraduate courses.

In 1907, Dr. Angle wrote as follows: "Until within a very few years the teaching of orthodontia in dental colleges was very superficial, even ofttimes being wholly omitted from the curriculum. Now, however, in all of our best colleges separate chairs have been established and the subject is more comprehensively taught. Yet this branch of the science is still made subservient to all others in dentistry, notwithstanding the fact that its exactions in teaching and practice are greater than in any of the other branches of dentistry. There should be still further radical improvements in its teaching, for it is an historical fact that no student has yet acquired at a dental college proficiency in this branch sufficient to enable him to succeed in its practice as a specialty. In fact, so exacting are its requirements, that, unlike the general practice of dentistry, the mere smatterer can never hope for even moderate success, for often apparently very simple cases of malocclusion are in reality only symptoms of conditions whose management requires the broadest knowledge and mature judgment. Orthodontia is a subject so great, so important, with such possibilities and rewards, that it is ample in itself for the life work of the best minds. For years it has been the author's firm conviction that it should be classed as a distinct specialty—taught and practiced as such; that it should be freed from the handicapping influences of general dentistry and given an opportunity to develop normally along lines which are so distinctively its own—lines which define it as a specialty as clearly as do those that define the specialty of ophthalmology . . . and rhinology."

With the establishing of the Angle School, as I recently wrote,[20] something entirely new in dentistry was created, for the school was not merely an elementary training school to turn out orthodontists after a certain number of weeks of theoretical study, but it became the center of orthodontic research; in fact the school was to be an orthodontic faculty, and the fate of the specialty depended largely upon the type of student who was to enter. Angle gathered around him and on his teaching faculty, for the first time, specialists in correlated sciences and art. The result of this contact upon his students and in turn upon the others associated with them, introduced into orthodontia new thoughts and fields, and in time they found their way into dentistry. The subjects which now constitute the broad science of orthodontia are anthropology, general and physical; biometrics; growth and development; education; engineering; endocrinology; genetics; habits and psychology; heredity and inheritance; metallurgy; nutrition; pediatrics; structural deformities; orthopedics and surgery. No one can say after such a grouping that orthodontia is just a problem of moving teeth. It is the connecting link between dentistry and medicine, extending into anthropology, physics, chemistry and art.

Today all of us feel that the teaching problem is still one of the great unsolved factors. The student in his undergraduate days receives some knowledge of the fundamentals and a general idea of treatment, so that those in the "out of the way" places can render some service to their patients. The rest is left to postgraduate work, and a few of the large universities now have good schools, properly equipped and manned, but they are too few in number; consequently the private schools, way below the standard and ideals put forth by the original Angle School are with us, with no supervision and little consideration for the patient's welfare. Besides, many hospitals have taken it upon themselves to establish "schools" in the name of clinics. The one encouraging sign is that our dental societies have dropped such courses from their routine postgraduate instruction. The time has long since passed when some regulation of specialists is needed. The American Society of Orthodontists, the leading orthodontic society, has set up an American Board of Orthodontia to aid in this problem, but the general aims and purposes are so misunderstood that it has not received the support it requires or deserves.

This situation might be summed up from a paper by Brodie.[21] He states: "This era witnessed the elevation of a branch of general dentistry to a distinct and powerful specialty, but it also witnessed an exhibition of the inevitable human weakness to cheapen and spoil that which has been found good. All sorts of men were given all sorts of short courses, and this vast influx of men, most of whom were attracted by the thoughts of monetary reward, has diluted the efforts of the few workers that the field has had during this period. Untrained in reasoning and indeed in any field save that of mechanics, this group has had little or no interest in the scientific side of the field wherein the problems of etiology lie hidden."

Before leaving this subject, permit me to review briefly a fairly recent paper entitled "Undergraduate Teaching of Orthodontia."[22] It not only focuses attention on the differences between orthodontia and dentistry, but I believe will answer the next question to be considered. These differences have never been appreciated by the profession, nor have they been given the serious consideration they deserve.

"Is orthodontia a specialty or is it just a part of dentistry? What is its relation to dentistry and medicine? In theory, in observation and in personal experience, I am forced to regard orthodontia as a specialty which bears a similar if not identical relation to dentistry that dentistry bears to medicine, if dentistry is properly considered. Theoretically, orthodontia is based upon entirely different fundamental sciences than dentistry. Malocclusion is not a disease; it is seldom associated with pathologic processes; it is a defect in development. . . .

"Dentistry is concerned with the diseases of the human mouth, their prevention, their cure, their consequences, and the restoration of the damage caused by them. It is evident that orthodontia and dentistry are based on different fundamental sciences. Orthodontia is related to dentistry only in that it originated in dentistry. Orthodontia is certainly more closely related to orthopedic surgery than it is to operative dentistry, or, I believe, any other field of dentistry. . . .

"In 1904 I came into contact with an institution teaching orthodontia, and I knew at the end of the first week that I had not the most fundamental conceptions of orthodontia; that I was thinking of alignment and of occlusion in the sense of teeth hitting together, and of the moving of teeth without any reference to whether that was where they belonged in the denture or not. I had little conception of the denture as a unit and less knowledge of the forces involved in its development. I quit practicing orthodontia. I went home and did not undertake another orthodontic treatment until I gave up the practice of dentistry. The fundamental philosophies which underlie the practice of dentistry and the practice of orthodontia are different. . . .

"All dental procedures are compromises. I believe no one would attempt to say that a tooth with a large gold filling in it is better than it was before a cavity appeared, or that a root carrying a crown is better than it would be if the natural crown could be replaced, but you are faced with the effects of a disease and you have to make a compromise operation which will restore the conditions to as nearly normal as possible.

"That is the rock which has wrecked the teaching of orthodontia in dental schools. When you attempt to restore a biological mechanism, you must at least aim at perfection. You must at least visualize the perfection in that development, and you must strive without ceasing to accomplish that ideal of biological development which has no compromise. Therefore I say that the fundamental philosophy of orthodontia and that of dentistry are different.

"In 1910 orthodontia appealed to dentistry to recognize it as an entity, related to dentistry and related to medicine, and dentistry refused. Dentistry said, 'Orthodontia is dentistry; it has always been done by dentists, and it is going to be done by dentists, and we are going to teach it from the dental standpoint.' The standard of orthodontic practice has degenerated from that date to this, until today the conditions with which we are confronted in the mouths of thousands of children in the United States are a crime.

"Why has dentistry failed to make orthodontists? . . . Dentistry has failed, in my opinion, to make orthodontists, first, for the reason I have already pointed out, that its fundamental philosophy is different. Second, it has failed because it has all of the time been, and still is, teaching not orthodontia but 'regulating teeth.' It has failed to follow either the development of the technique of orthodontia or the development of orthodontic reasoning. It is still teaching orthodontia to dental students as the moving of teeth into line, without any reference to their relationship to each other, using appliances which in many instances could never produce the tooth movements which are necessary. The student is given the idea that when he graduates he is a master of orthodontia as well as of every other specialty of dentistry.

"Dentistry has failed to produce orthodontists because it has failed to recognize the facts that in thirty-odd years orthodontia has developed a technique of its own which is unknown in dentistry or in any other phase of human endeavor, and this technique is scarcely related to dental technique. This does not mean that there are not applications of dental technique in orthodontia, but orthodontic technique has developed independently and outside of the college of dentistry.

"I pointed out many years ago that even in soldering, dental soldering and orthodontic soldering are fundamentally different. In dental soldering the maximum of solder and the minimum of plate are used. Orthodontic soldering is based upon the principle of uniting two pieces of metal with the minimum of solder. Where will you find that principle in dental technique?

"Orthodontic technique is based upon acquiring the skill to solder things with the free hand, which are in perfect relation to an ideal, a skill which can be acquired. Dental technique depends upon placing the pieces in solid investments and holding them in relation by cumbersome arrangements while they are united, with a maximum of solder and a minimum of plate. You can scarcely find a point in which dental technique and orthodontic technique come together. Even in the technique of taking impressions of the mouth, orthodontia had to develop a procedure of its own, and now it is used in no place in dentistry; only in orthodontia.

"These are some of the reasons why I think we have failed to teach orthodontia in the dental school. I have exerted all the energy, mental and physical, that I possess with senior dental students and I have failed to make an orthodontist out of one of them. Some of them are practicing orthodontia. No, I doubt that. I do not know of one except those who have taken orthodontic training since. I have never succeeded in the few hours a week interpolated in dental practice in orienting dental students in orthodontia. I have never been able to make them see that the problem is not to move teeth. I have said to them many times that I can take a freshman dental student and teach him to move teeth in six weeks, but in six years I cannot teach him to know where the teeth belong and in which direction and to what extent they should be moved. I can start him on the lines of thought that eventually will give him judgment that will be worth something, but he has got to think, he has got to use fundamental sciences and his knowledge which has been derived from them. There is no measurement that can be given. We cannot mark out the skull and say, 'You should move it to here or to there.' He has got to study the types, the fundamental things in biological development, until he has developed sufficient judgment to obtain results that will be within the possibilities of development. You cannot tell him; you cannot even tell him how much force he must apply to this tooth in order to obtain a reaction in the tissues, because there are no two tissues alike. You have got to make him think in terms of cells and cell reaction, so that every time he exerts force upon a tooth, he thinks, 'What is this doing?' And he notices whether it is doing too much or too little. That is judgment. The dental student wants to be told exactly how much force he should use and why. It cannot be done."

These thoughts and opinions just quoted were written by Dr. Frederick B. Noyes, a dean of one of our largest and leading dental colleges, a graduate in dentistry in 1895 and the author of a textbook on dental histology and embryology, the first edition in 1912 and the fourth in 1930. From 1895 to 1904, he "practiced orthodontia, with a biological background" as a general practitioner of dentistry, and he sums up this experience as follows: "I now recognize how badly they were handled and how imperfect were the results."

I believe that Dr. Noyes has clearly presented the situation and why the dental schools fail to teach orthodontia and qualify men to practice it. Fundamentally dentistry and orthodontia differ, and a study of this problem over a period of almost forty years has convinced orthodontic as well as dental educators that at least a full year of postgraduate study under the auspices of our important university schools must now be taken before a man may qualify for the specialty.

SHOULD THE GENERAL PRACTITIONER PRACTICE ORTHODONTIA AS ROUTINE OFFICE PROCEDURE, OR SHOULD HE BE GUIDED BY AN ORTHODONTIST, OR SHOULD THE PRACTICE OF ORTHODONTIA BE LIMITED TO THE SPECIALIST

Upon an analysis of the above statement of Noyes, there can be no hesitancy as to the answer to this question: orthodontia can be practiced only by a specialist. There are, however, many cities and towns in which there are none, and in which many dentists feel that they must practice it and will continue to do so; they should recognize the difference between orthodontia and merely "straightening teeth" and inform their patients of this, and that they will perform their work to the best of their ability under the circumstances. To those who "treat only simple cases" a word of caution might be in order. Those are the very cases that tax the ingenuity and ability of the best orthodontist and become the greatest problems. The dental profession must be made to realize this situation, to meet it squarely and to help to elevate this branch of their profession.

NEED OF COOPERATION BY THE MEDICAL PROFESSION

I have called attention to the introduction into orthodontia of such subjects as endocrinology, diet and metabolism and arrested development, but all these fields have been found so vast and the profession has been so poorly equipped to evaluate them that application of what findings there are has been made in the most superficial manner, and to date they are of little or no practical use to the clinician. Besides those mentioned, we have the rôle of constitutional factors, habits, heredity, form and function, growth and development.

The physician, knowing the general health and growth record of the patient, can supply us with valuable data. His records of lengthy illnesses, with accompanying high temperatures, early feeding and nutritional changes, are of great assistance as well as data relating to congenital defects, hereditary tendencies, endocrine imbalances, functional and developmental changes, irregularities in growth changes, height and weight charts, roentgenographic studies, and such other factors which, if put at our disposal, will aid us ultimately to understand and to know our problems. It is this assistance we desire and ask, and we would welcome a closer cooperation by a scientific study of special studies along these and other lines and under their control.

The dentist, having our patients under his supervision long before we see them, can be of material aid in helping us, for it is quite possible that he may have had these patients under observation and has obtained valuable information essential to the consideration of our problems. Pernicious habits may have been broken, frenums operated upon, supernumerary teeth removed, the drifting

of teeth observed, etc. Not all general practitioners recognize the importance of observations of a developing denture and record such data. If, however, in the future, this procedure were to become routine in their practices, the problems of orthodontia would become simpler.

CONCLUSIONS

In this paper I have considered only the medical problems in orthodontia; therefore no mention has been made of the mechanical phase except from the historical aspect. The rôle of the orthodontist is the correction of dental and maxillary irregularities with the consequent malocclusion. A rational treatment of such abnormalities embraces, as Dr. Hrdlicka recently presented before the orthodontic society, "on the one hand a constant consciousness of the basic realities of the subject and, on the other, a consciousness of the dangers confronting the procedures of correction." These dangers, as seen by an outsider, would be:

1. Insufficient regard, during the period of childhood especially, but also in adolescence, of the unfinished development of the jaws and accommodation of the teeth.

2. The allure of bringing all dentures to one ideal type.

3. The acceptance of fixedness for any of the points from which it is necessary to take measurements.

Today there are three distinct ideas or chains of thought in orthodontia. One is that practice is nonmechanical and ultimately there will be no need for treatment, provided diet, heredity, endocrine imbalances, etc., can be properly regulated. That is but a dream and a hope in the far distance. The second chain of thought is the concept that orthodontia begins with an appliance and ends there, where diagnosis, etiology, disease and health are given little or no consideration. Those who have this idea make up the vast majority now trying to practice this branch of dentistry which should be designated as "straightening teeth" and not orthodontia. There is the third chain of thought, midway between the two extremes, where men realize that the use of appliances is but a means to accomplish a purpose. The perfect or ideal appliance has not yet been found, and little is known as to the mechanics of force and its application. Even when the most careful treatment has been carried out, failures result, not because of lack of mechanical ingenuity, but to a causative factor either unknown or not understood. The true concept of orthodontia, therefore, must be that as expressed by McCoy, and the one I believe to be followed by the majority of the members of the American Society of Orthodontists.

To sum up the various points brought out in the course of this presentation, it may be stated that:

1. The psychological attitude of our little patients is a great factor in orthodontia. From the beginning, esthetics was the primary factor in considering orthodontia, which should now be changed to the more important problem of the mental situation.

2. The change in the early conception of orthodontia from a "science which has for its object the correction of malocclusion of the teeth" to "a study of

dental and oral development, seeking to determine the factors which control growth processes to the end that a normal functional and anatomical relationship of these parts may be realized, and to learn the influence necessary to maintain such conditions when once established."

3. That irregularities in the position of the teeth, unerupted, supernumerary, retained and impacted teeth date back to the earliest remains of man, as well as the problem of caries. Beginning with Hippocrates (468 B.C.) attention was paid to such conditions and attempts were made to correct them. That the basic appliance for treatment dates back to Pierre Fauchard, the father of dentistry, 1728, and that this period, up to 1900, was known as "straightening teeth."

4. In considering the history of the development of orthodontia as a special branch, emphasis was placed upon the following points:

a. Mechanical devices and manipulative skill were the outstanding features in furthering orthodontic practice, and with standardization and systematization, the profession as a whole began to straighten teeth.

b. With the establishment of the Angle School of Orthodontia, a complete change in this branch of dentistry resulted. Angle, in realizing the danger of indiscriminate use of appliances by the uninformed or unskilled, began to make a specialty. His concept of normal occlusion became the basic foundation for orthodontic operation and furnished the starting point for its practice.

c. A systematic and scientific investigation of the idea of normal occlusion revealed that we had to deal with "averages" and that the normal was but an "ideal" seldom found.

d. Observations on the incident of normal occlusion prove that it compared with other natural phenomena of life.

5. As to the prevalence, malocclusion is to be found throughout the world. Beginning with birth, where 30 per cent have been found to have it, it increases in girls at the age of eight years to 80 per cent and in boys at ten years to 83 per cent, then a rapid decrease varying from 35 per cent to 59 per cent.

6. In presenting three groupings of etiologic factors that have been advanced, "most of the conclusions at which we have now arrived seem to be negative." Our old theories are not sufficient, and a more general knowledge of the growth of the individual and how he is affected by various factors is essential.

7. The age when treatment should begin does not depend upon the irregularities in the teeth but must be based upon experience and the physical growth and development of each individual.

8. Inadequate teaching of orthodontia in undergraduate colleges prior to 1900 resulted in the formation of private postgraduate schools. Recently postgraduate courses have been added to the college curriculum, but they are too few in number and the private course is still with us, far below the standard set by the original school. The leading orthodontic society has under its direct supervision the American Board of Orthodontia, but the general aims and purposes are so misunderstood that it has not received the support it requires or deserves.

9. As dentistry is concerned with the diseases of the human mouth, their prevention, their consequences and the restoration of the damage caused by them,

while malocclusion is not a disease, seldom associated with pathologic processes, but is a defect in growth and development, therefore it is evident that both are based upon different fundamental sciences. Orthodontia, meanwhile, has developed a technique of its own which is unknown in dentistry, and as a result only those who mastered these vital differences should undertake an orthodontic case.

10. Orthodontia today is the result of the efforts during the past thirty years of that determined group of men who realized the inadequacy of their knowledge and strove to correct that situation. Today the broad subject demands a knowledge of anthropology, general and physical; biometrics; growth and development; education; engineering; endocrinology; genetics; habits and psychology; heredity and inheritance; metallurgy; nutrition; pediatrics; structural deformities; orthopedics and surgery. As a result of these specialized studies in orthodontia, they have now become a part of dentistry.

Orthodontia seeks the cooperation of all. We need your help and assistance so that we might better understand and master the many problems with which we are confronted.

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SPACE MAINTENANCE

Its Theory and Practice

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THE existence of equilibrium in a denture makes normal function possible if the owner of that denture does not subject it to uses of a perverse nature. If a normal relationship exists between the maxillae and the cranial and facial bones, and there is a normal temporomandibular joint, the foundation of dental equilibrium is well established.

With the eruption of all teeth, within limits reasonably approaching established averages and in proper relationship to each other, in the same as well as in opposing arches, we are a step further advanced toward such an ideal.

The mechanism thus far developed is influenced by certain forces, which were tabulated originally by Angle, but more recently have been reclassified by Sved as follows:

A. Intraalveolar forces:
   1. Normal cell metabolism.
   2. Normal approximal contact.
   3. Harmony in the size of the arches.

B. Muscular activity:
   1. Muscular pressure.
   2. The force of the inclined plane.
   3. Atmospheric pressure.

Sved continues: "The forces which act upon a normal denture are either internal or external in origin. The internal forces originate in the alveolar bone and are manifested in the individual tendencies of the teeth. The external forces are all the result of muscular action and represent the influence of that part of the mechanism which is responsible for motion and force."

Should all the foregoing factors be present in the same individual, in equilibrium, the result would no doubt be the functional ideal for that individual. Augmented by proper care and use, little, if any, deviation from this condition would be permitted.

However, certain factors, either singly or in groups, are effective in upsetting the existent equilibrium, thus presenting an operative as well as a developmental problem of importance to those who have child patients.

Any loss of mesiodistal space presents a contingency which results in the loss of equilibrium, development of malocclusion and preparation of the denture for periodontal disease in later life.

Read before the Old Dominion Dental Society, Lynchburg, Va., May 1, 1937.
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Situations which are conducive to the loss of mesiodistal space are those which involve the loss of tooth substance. They may be grouped as follows:

1. Loss of tooth substance from the mesial or distal aspects of teeth through caries or tooth fracture.
2. Failure of the operator properly to contour artificial restorations of tissue.
3. Premature loss of deciduous teeth.
4. Loss of deciduous teeth coincident with a congenitally missing tooth germ.
5. Loss of permanent teeth.

Any of the above conditions will be destructive to at least three of the forces of equilibrium in the denture:

1. Normal approximal contact.
2. The force of the inclined plane.
3. Harmony in the size of the arches.

When such a situation arises in a patient who is already in the hands of an orthodontist, or who is within easy reach of one, the decision is usually made in favor of preserving, or maintaining, the space thus created until artificial restoration is expedient, or of closing the space and, by reshaping certain teeth by established procedures, obtaining as nearly a functional occlusion and cosmetic effect as is possible without artificial restoration.

Orthodontics, however, is still in a large measure attainable only by a greatly restricted group.

In many instances great benefit is attainable by the use of a device which preserves the space thus created, subsequent developments enabling the patient to escape the impairment of an efficient denture.

When tooth substance, either in part or as a whole, is lost, what are the natural tendencies of the remaining teeth? It is necessary to understand this at the beginning so that these tendencies may be adequately antagonized and the wandering of unsupported teeth prevented.

For purposes of illustration Hellman assumed that certain forces are exerted upon teeth during mastication. By the use of diagrams of these forces (Figs. 1, 2 and 3) and their resultants, he has shown what one would be led to expect. He concludes as follows: "However, there are certain tendencies of migrating teeth which do not coincide with these rules:

"1. Following the extraction of the upper second premolar, or of the second deciduous molar, the teeth remaining distally will move mesially.

But, when the *first* deciduous molar is extracted the second deciduous molar *will not* move mesially.

"2. Following the extraction of the lower second deciduous molar, or second premolar, *the movement of the remaining teeth is not bodily forward as in the upper jaw.* They *tip* forward.

"3. When the deciduous first molar is extracted, *the deciduous canine moves distally.*

"4. With the loss of the first lower permanent molar the second molar will tip forward and lingually *but the anterior teeth will move distally.*

"These diverse movements of teeth cannot be explained satisfactorily upon a mechanical basis. There must be a vital factor also. Surface tension of cellular elements, circulatory influences, and the elasticity of connective tissue fibers must be considered."

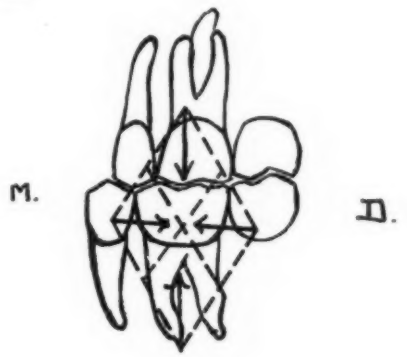

Fig. 1.

Fig. 2.

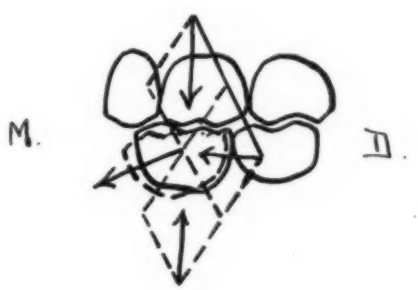

Fig. 3.

Sved, in a much more recent survey, amplifies the foregoing to this extent: "In general the earlier in life the injury occurs the greater will be the disturbance. Thus, the very early loss of the second deciduous molar may result in a marked forward drift of the permanent molars or in the impaction, or malalignment, of the second premolar. The loss of the second premolar, which follows the second deciduous molar, cannot have such a marked effect, for even before the second premolar erupts the permanent molars are already in position and are properly locked.

"The early loss of the deciduous canine should be carefully guarded against. Since the permanent canine is usually the last tooth to erupt in front of the first permanent molar, the early loss of the deciduous tooth allows a longer period during which migration of the other teeth may take place. This results in frequent impactions and malalignment of the permanent canines."

In dealing with situations which involve the maintenance of space occasioned by the loss of tooth substance the operator should be careful to note whether, in addition to loss of contact or loss of teeth, there may be a subnormal development in the arches. Such cases are always inadequately dealt with when space maintainers are inserted. Active orthodontic treatment is indicated.

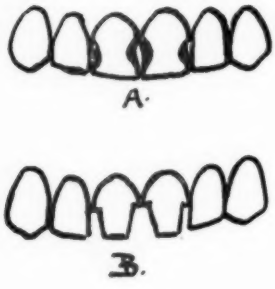

Fig. 4.

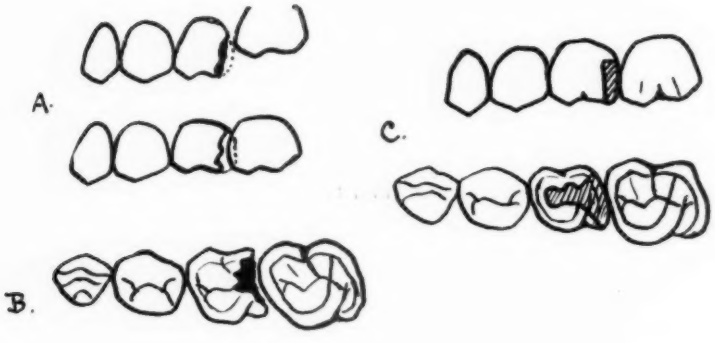

Fig. 5.

The simpler problems involving possible loss of mesiodistal space occur and may be handled as follows:

1. Loss of tooth substance through caries or fracture.

a. Where approximal caries exists in deciduous central incisors to the extent of involvement of the incisal angles, if the patient is three years of age or more, the teeth may be disked to a wedge shape. Care must be exercised to leave the cervical third of the crown intact, since these teeth are "bell-shaped" and the contact may be preserved at this level. (Fig. 4.)

b. If the distal surface of the second deciduous molar is carious, and in many of these cases the destruction is extensive, the restoration should be carefully carved and contoured to anatomical proportions. (A metal filling is indicated.) One of the functions of this tooth is to guide the erupting first permanent molar

into place and into its proper relationship with its antagonists. One should not be overzealous and overcontour such restorations. This results in wedging the erupting first molar distally. (Fig. 5.)

c. In a similar manner loss of tooth substance through caries or accident should be remedied in other teeth, deciduous and permanent, in order to preserve the natural contact points and the mesiodistal length of the arch.

2. Loss of individual deciduous teeth.

a. Avoidable loss. By this is meant the extraction of teeth which by operative procedures may be maintained in relative health and function until their exfoliation time. Extractions based upon hasty judgment promote, by loss of contact, an impairment of function and subsequent malocclusion.

Exfoliation and eruption periods of teeth are variable in different individuals. Although they are not usually so to a marked degree, one must be on guard against wide variations (tuberculosis and rachitis), and must allow for variations within normal limits. Where deciduous teeth are involved, particularly when the choice must be between extraction and preservation, one must be certain that there is a permanent successor. Missing tooth germs are sufficiently

Fig. 6.

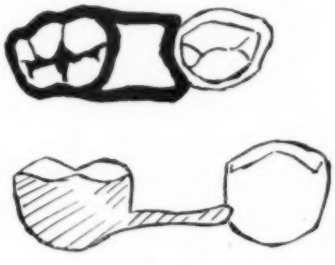

Fig. 7.

common to make the use of the roentgenograph mandatory. In any case a deciduous tooth in sufficient health to render functional service should be kept in place until its normal exfoliation time, and, in the absence of a succeeding tooth, for a much longer period.

b. Loss of individual teeth (unavoidable). In this situation (except in those cases in which it is deemed advisable to close the space) the use of the space maintainer is indicated. The space may be maintained until the succeeding tooth erupts or until the patient is ready for artificial restoration of the missing organ.

The best type of mechanism for this purpose must fulfill the following requirements:

1. It must maintain the space occupied by it.
2. It must permit of normal mobility in function of the teeth to which it is attached.
3. It must restore lost function.
4. It must be noncorrosive, hygienic and esthetic (within reasonable limits).

The diagrams in Figs. 6-16 show various types of devices which have been designed for this purpose.

In Fig. 6 the anchor teeth are banded and connected by a bar which extends through the buccolingual center of the space, both ends being soldered. This type does not permit of individual mobility of the anchor teeth while in function. It does not restore the function of the missing tooth and, unless carefully controlled, it will interfere with the eruption of the permanent tooth.

In Fig. 7 the tooth distal to the space is used as an anchor tooth. To this band is soldered a U-shaped or circular wire which rests passively against the tooth mesial to the space. It does not restore the function of the missing tooth and is unstable because of its free anterior end which permits of vertical distortion.

In Figs. 8 and 9 the tooth distal to the space is used as an anchor tooth. A wire is soldered to this band, extended across the bucco- or labiolingual center of the space with a sort of half clasp and lug rest embracing the next adjacent tooth. This device also does not restore function and, unless closely watched, it will interfere with the eruption of the succeeding tooth.

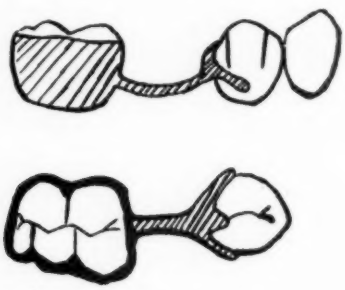

Fig. 8.

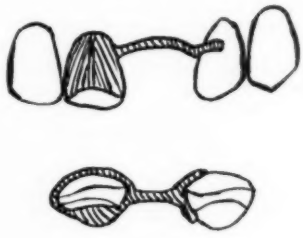

Fig. 9.

Fig. 10.

In Fig. 10 the teeth mesial to and distal to the space are banded. To one band a wire is soldered and bent in the shape of an S. Its free end fits into a horizontal tube which is soldered to the opposite band. It does not restore the function of the missing tooth and, unless closely supervised, it will interfere with the eruption of the succeeding tooth.

In Figs. 11 and 12 the appliances are made according to the principles of the lingual retainer. They do not restore the function of the missing teeth.

The device shown in Figs. 13 and 14 may be made in one of two ways. Bands may be applied to the anchor teeth or cast overlays may be used. The latter are to be preferred inasmuch as bands will split if subjected to any degree of strain near their edges.

In both cases a vertical tube is soldered to one of the attachments which supports the free end of a device which is soldered to the other attachment and maintains occlusal relationships. The type in which cast overlays are used is no

doubt the ideal type of space maintainer for the area illustrated above. It permits of mobility in function, allows space for the eruption of the succeeding tooth, and restores the function of the missing tooth; thus, at the same time, it prevents extrusion of the opposing tooth or teeth. (For intimate details see references under Willett.)

In Fig. 15 this maintainer, also after Willett, is designed for use when the second deciduous molar is lost and the first permanent molar is to erupt shortly.

Fig. 11.

Fig. 12.

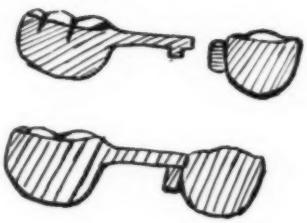

Fig. 13.

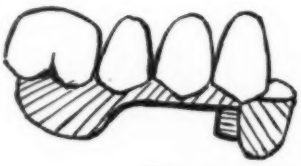

Fig. 14.

Fig. 15.

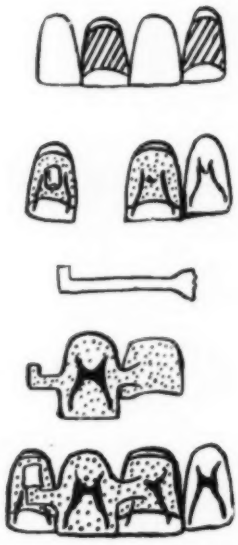

Fig. 16.

Two teeth, the deciduous canine and the first molar, bear cast overlays (for strength) while the extension serves the threefold purpose of restoring the function of the missing tooth, guiding the first permanent molar into place, and maintaining the space created by the loss of the second deciduous molar.

While the principle used here is in violation of crown and bridge procedure, inasmuch as a bridge of the same type would be a cantilever affair, its use in this case, for a short time only, may have its justifications.

Fig. 16 shows what is sometimes called the orthodontic bridge. An attachment band is applied to each abutment. To the lingual aspect of one of the bands a vertical tube is soldered; the missing tooth is supplied by the use of a pin facing, a Steele facing or a Trupontic.

The assemblage is accomplished by the use of a bar which is soldered to one band and the dummy (lingual contour being given the dummy during the soldering process), from which point support is obtained on the opposite band by means of a right angle bend in the bar which is received by the vertical tube previously mentioned.

Finally, it should be remembered that when a number of deciduous teeth are lost prematurely, through the inroads of caries, functional activity, occlusal relationships, the length and width of the arch and esthetics may be best restored by the use of partial dentures, which should be made as light as is consistent with strength.

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REVIEW OF THE LITERATURE ON CHANGES IN BONE AND SURROUNDING TISSUES DURING EXPERIMENTAL MOVEMENT OF TEETH

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THE fact that the first written record contributing to orthodontia was made in 1723 by Pierre Fouchard, 115 years before the establishment of the cell theory by Schleiden and Schwann (1838) is justification for a long period of empiricism in the treatment of dentofacial abnormalities. However, so great has been the progress of biology in the century since the formulation of the cell theory that such justification is not now possible. The mention of a few contributors to biology during the century from 1838 to 1935 would be unjust to the rest of the investigators in this field. To mention them all would be beyond the scope of this paper and my ability to do so. Suffice to say, that the knowledge available by their work exceeds its clinical application.

With few exceptions, the early contributors to orthodontia concerned themselves with perfecting appliances which seemed indicated by clinical experiences. That teeth were moved by pressure stimuli was evident to these men. The physiologic processes involved in these movements were, however, a matter of speculation.

The early workers in orthodontia, however, did heroic work, considering the knowledge and materials available to them.

There were two accepted theories in regard to tissue changes during tooth movement before this problem was approached scientifically.

One of these theories (Schwalbe-Flouren) was that when pressure was applied to a tooth, the bone on the side of pressure was resorbed, while on the side of pull or side of negative pressure, there was a deposition of bone. The other theory, advanced by Kingsley and supported by Walkhoff, supposed that tooth movement was effected by pressure because of certain theoretical properties of bone, such as elasticity, compressibility and extensibility. These terms were used by these men in a very literal sense and not in the limited sense that such physical properties are attributed to bone at present.

The first systematic experimentation on the tissue changes during tooth movement was made in 1904 by Carl Sandstedt who chose a dog as his experimental animal.

The appliance used was a maxillary labial arch extending from cuspid to cuspid. The arch was tightened by means of nuts placed distal to horizontal tubes soldered on cuspid bands. The force exerted by this appliance pushed the incisor crowns lingually and pulled the cuspids mesially. By daily tightening this force was applied constantly for three weeks. During this experiment the crowns of the central incisors were moved about 3 mm. lingually. No mention is made of the effect of the pull, if any, on the cuspids.

Histologic sections were obtained from the gingival third of the moved teeth and interpreted by Sandstedt as follows:

1. On the side of pull, or negative pressure, with both weak and strong forces, a deposition of bone takes place on the old alveolar wall. The newly formed bone spicules follow the direction of the strained peridental fibers.

2. On the side of pressure the old alveolar bone is resorbed by weak forces. The surface of the tooth remains intact.

3. Strong forces at first compress the peridental membrane on the side of pressure and the resorption of the alveolar bone in the area of greatest pressure is delayed due to interference with blood supply. However, an active resorption takes place in the neighboring marrow spaces of the alveolar bone. When the alveolus supporting the tooth against strong pressure is sufficiently undermined, the tooth assumes at one pull a new position. This process is called "undermining resorption" by Sandstedt. He also concluded from a study of his slides that a tipping pressure applied to a tooth caused it to rotate on an axis located somewhere in the apical half of the root.

In 1911 Oppenheim published his comprehensive work relative to tissue changes occurring during tooth movement. For his experiments Oppenheim produced various tooth movements on the deciduous teeth of a young baboon.

One side of the arch was used as a control, the other subjected to the appliance. An Angle labial arch was used with ligatures for tooth movements. Movements made were: labial, lingual, depression, rotation, elongation.

After forty days of application of force, histologic sections were made of the teeth and surrounding tissues. From these slides Oppenheim came to the following conclusions regarding tissue changes in tooth movement.

Bone changes in the labial movement of a tooth: There was complete reconstruction of the labial alveolar bone in the gingival third (side of pressure), the whole extent consisting of newly formed bony spicules or transitional spongiosa which were in a vertical position to the tooth root and extended toward the labial. Osteoblasts were demonstrated on the transformed alveolus, on the side toward the tooth. Osteoblasts were found on the tips of the newly formed spicules toward the labial. The apposition of new bone was greater, however, than the rate of absorption. The apical third of the alveolus is less changed and retains its lamellar structure. Osteoclasts were seen on the tooth side of the process in this region. The peridental membrane is compressed on the side of pressure to about 0.09 mm., one-third its normal width which is 0.27 mm. That cells of the various tissues retained their vitality was evidenced by staining reaction and observation of mitotic activity.

The characteristic direction of the fibers of the peridental membrane and the ligamentum circularis suffered no disturbance.

The lingual side, or the side of negative pressure, of the alveolus in the labial movement showed, also, complete reconstruction of the alveolus as observed on the labial side. On the lingual side, however, the bone spicules were directed toward the tooth in a vertical position with numerous osteoblasts on the ends toward the tooth. Osteoclasts were present on the spicule ends directed away from the tooth.

Oppenheim states that in lingual movement on the lingual side (side of pressure) analogous changes occur to those on the labial side in the lingual movement. The histologic picture (Fig. 7 of Ref. 3) which he presents for evidence, contradicts this statement. The spicules or new bone formations show osteoblastic activity on the tooth side which is opposite to the picture presented in Fig. 4 (Ref. 3) for side of pressure in labial movement.

On the side of pressure in lingual movement the periosteum was compressed to one-third its normal width. There was no change in either the cementum or the gums.

Regarding the labial side or side of pull in lingual movement, Oppenheim states: "The compact bone about the alveolar margins is considerably thickened by the formation of new spongy bone spicules forming parallel to the line of force. . . . The alveolus is thickened in its entire length but gradually assumes its normal thickness toward the apex of the tooth."

Compact bone is still demonstrated in the apical third of the tooth, but in the gingival third the alveolus has changed entirely to spongy bone with osteoblasts in evidence on the side toward the tooth.

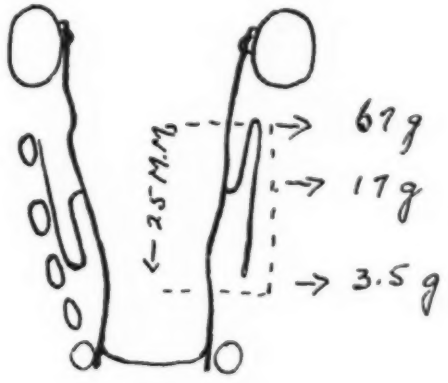

Fig. 1.

In elongation, it was also found that the bone grew in newly formed spicules parallel to the direction of force. Growth was most active in the apical region and at the gingival border of the alveolus. The peridental membrane was stretched to almost twice its normal thickness in the apical half of the root.

In depression, Oppenheim was unable to demonstrate reliable results because of the proximity of the crowns of the permanent teeth to the deciduous tooth roots.

From his histologic material Oppenheim concluded that a tooth under tipping force rotated on an axis located in the root apex.

Martin Schwartz reported the following experiments relative to tissue changes during tooth movement: In his investigations Schwartz used a lingual arch wire attached to the banded molars and cuspids of several dogs. Pressure was applied to the three posterior premolars on both sides by means of recurved auxiliary springs of a known force at 1 mm. tension. The force exerted on the various premolars is indicated in Fig. 1.

Force was applied to the teeth for five weeks with two adjustments of the spring, one at the beginning of the experiment and the other two and one-half weeks later.

As a result of study of the histologic slides made from the teeth and tissues involved, Schwartz came to the following conclusions: that the theory of compressibility of bone (Kingsley) was refuted as the pressures used were too slight to account for movement in this manner. This also refuted Mershon's "latent development" theory as the teeth in the experiment were moved beyond their normal limits by slight pressure. He concluded also that force applied to teeth should not exceed the blood capillary pressure of mammals which is comparable to 20 to 26 grams pressure for 1 sq. cm. of surface.

As Schwartz' histologic findings and conclusions are quite identical with those of Sandstedt, there is no need of discussing them to any great length.

From this experiment he concluded that the findings of Sandstedt were correct from the standpoint of modern orthodontia.

Schwartz classifies appliance pressures according to biologic effect into four divisions:

1. In first degree of biologic effect the pressure is so slight or of such short duration that no reaction is evident.

2. In second degree of biologic effect, pressure is gentle, constant and below the pressure of the capillaries but causes resorption of bone in regions of pressure in conjunction with osteoblastic activity.

3. In the third degree of biologic effect the force applied is greater than the pressure in the blood capillaries and causes suffocation of the peridental membrane in areas of pressure. This causes the "undermining resorption," described by Sandstedt. It also causes areas of resorption on the tooth root.

4. In the fourth degree of biologic effect the pressure or force is so great that the peridental membrane is crushed and the tooth is forced against the alveolus. The results are the same as in the third degree effect except that destruction of the tissues is greater with tearing of the peridental membrane. Also the teeth may be devitalized or ankylosed with the alveolus or both may occur.

The next article to be reported on here is a review of the work of Gottleib and Orban by C. Boedecker. In the comprehensive experiment started in 1925 and not yet translated to English 50 dogs were used. The various experiments lasted from twelve hours to thirteen months. Teeth were moved by means of capping, which produced inclined plane action. The experiments were primarily performed to clear up certain points in root resorption and the rôle of trauma in peridental diseases. The histologic findings in tooth movement largely agree with the conclusions of Sandstedt and Schwartz. However, Gottleib and Orban do clear up one point neglected by Schwartz; namely, the reconstruction of bone on the side of pressures. According to these investigators, absorption and deposition of bone go on simultaneously on the side of pressure. Osteoblastic activity goes on in the medullary spaces of the bone in back of the lamina dura. They agree with Schwartz that the tooth under tipping pressure tends to rotate on an axis located somewhere in the apical half of the root. Gottleib and Orban also found that absorption

of the alveolar process in tooth movement varies with the age of the animal, being usually more rapid in the young than in the old animal.

J. A. Marshall of California has also contributed much to the literature on the above subject, this being incidental to experiments made to study the causes of radicular resorption of tooth roots. As Marshall's main interest lies in the latter subject, he makes only a few comments on the bone changes in tooth movement. The value of his experiment on this subject at present seems to be the great degree of attention paid to all details.

Before summarizing the findings of the above investigators, a brief review of bone formation and growth would seem pertinent.[5] The skeleton in mammals is formed in two ways. The bones of the entire body with the exception of the flat bones of the face and the skull are first laid down in the embryo as hyaline cartilage, which later in fetal life is replaced by bone. This is known as intracartilaginous or endochondral ossification. The other type of ossification in which bone is formed directly from the mesenchymal blastema is called intramembranous ossification. As endochondral bone formation proceeds exactly as intramembranous ossification after certain changes in the cartilage cells only intramembranous bone formation will be described.

In this type of bone development certain groups of mesenchyme cells collect into an irregular membrane around bundles of delicate collogenous fibrils (osteogenic or Sharpey's fibers). These cells then begin to function as osteoblasts and deposit an osseous matrix among the fiber bundles. This marks the center of ossification of the future bone. Outlining the limits of the young bone is a dense layer of mesenchymal cells of fusiform shape. This is the primitive periosteum of the forming bone. As the trabeculi grow, they unite into a sponge-like structure and enclose a vascular mesenchyma, the primary marrow. The bone also enmeshes the osteoblasts which become the future bone cells. The trabeculae of young bone are lined with one or several layers of osteoblasts; also numerous multinuclear cells (osteoclasts) are present so that the inner conformation of the growing bone may continually change.

The bone when mature presents the typical haversian system. The periosteum is said to form the cortical plates of the bone. The process of regeneration of bone is commonly thought to be due to the osteogenetic activity of the periosteum. However, according to MacEwen[6] and Lerich and Policard, the periosteum is a limiting membrane of bone growth and has no osteogenetic function. MacEwen believes that mature bone cells may under certain conditions return to their embryonic osteoblastic state. Lerich and Policard have advanced a theory of bone formation as "a condition of osseous metaplasia of fibrous connective tissue" (Jordan). Osteoblasts play a minor rôle in this process. The theory of functional form of bone proposed by Wolff and Raux and supported by the work of Koch is of special interest and importance to the orthodontist. Wolff's law states "that all changes in the function of bone are attended by definite alterations in its internal structure." The orthodontist from clinical observation also notes that changes in function may alter the gross structure of bone.

In summarizing, the differences of opinions of the various workers will be noted, also the results of the experiments which seem most vital to the rational treatment of malocclusions mentioned.

Oppenheim concluded from a study of his slides that under both pressure and tension there was complete transformation of the alveolar bone into a transitional spongiosa. Sandstedt, Schwartz, Gottleib and Orban did not find such a transition of the alveolar bone but did find a deposition on or resorption of, or both, of the old alveolar wall. The bone changes indicated by the schematic drawings by Boedecker of Gottleib and Orban's findings seem to be the most reasonable explanation of this matter.

The experiments of Schwartz are valuable because he used pressures of a measured intensity which acted constantly. He was able from this to determine the limits of force within which tooth movement may be effected without morbidity of the involved tissues. His findings support the use of auxiliary springs (Mershon) the force of which is within the optimum range indicated by his findings, i.e., not greater than capillary pressure.

Most of the investigators agree that under a tipping pressure a tooth rotates on an axis located in the apical half of the root. Oppenheim states that a tooth under tipping pressure rotates on an axis located in the apex of the tooth. The differences of Oppenheim's findings are probably due, as pointed out by Schwartz, to uncontrolled factors in his experiment.

All these investigators have pointed out the fact that depression of a tooth is the most hazardous movement, due to trauma of the apical tissues and the probability of pulp strangulation.

The work of all these men has been of great value to orthodontia in putting it on a firmer, scientific basis. It would seem, however, that more complete and better controlled experiments are indicated along the same line. Schwartz showed the necessity of using a known and controlled force. Gottleib and Orban showed that age affects the result; Marshall has shown the importance of the dietary factor. More recent work by Johnson and Cross has shown the importance of genetic factors in such experiments. It would seem that all these details must be considered and controlled in adequate experimentation for the study of tissue changes in tooth movement.

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741 DAVID WHITNEY BLDG.

CASE REPORTS

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CASE 1.—A. H., ten years old. This case is one of incipient malocclusion of the so-called Class I type. No definite cause can be assigned to this type of case except that the arches did not have sufficient functional stimulus to develop them sufficiently to accommodate the full number of teeth.

Prognosis.—The prognosis was good for the reason that the growth obtained in this manner has little tendency to reversion.

Treatment.—The treatment was completed with one lingual wire applied to the mandibular arch, together with the masseter-temporal exercise. A very slow and gentle stimulus was used in order to maintain a good cusp relation and to transmit the force to the maxillary arch. The force was obtained by using the spring in the arch wire itself, activated by the loop. No force was applied directly to the maxillary arch.

CASE 2.—B. B., twelve years old.

History.—Some points in the early history of this case are of interest in connection with its etiology. Both parents had mild distoclusion although of different types from the case at hand. There was a tendency toward mouth-breathing complicated by a hypotonic condition of the orbicularis oris muscles. The tongue was large and protruded during the act of swallowing. The parents were concerned over the fact that the child had sucked his thumb, but the malocclusion was not of the type which was caused by this habit. Tonsils and adenoids had been removed.

Diagnosis.—Distoclusion with extreme protrusion of maxillary and mandibular incisors.

Etiology.—The poor muscle tone together with a lack of balance between tongue and lip muscles was considered to be the principal cause of this malocclusion.

Prognosis.—The placing of the teeth in their proper alignment in the arch was not difficult in this case, but the prognosis depends upon the ability to establish a normal muscle function and to overcome the faulty swallowing habits. This fact was explained to the parents before treatment was started.

Treatment.—The retraction of the maxillary incisors and the closing of spaces was accomplished with the high labial wire which was later changed to a straight labial wire.

The lingual wire with labial section was used on the mandible to correct the protrusion of the incisors and also to shorten the arch. Intermaxillary elastics were used to stabilize the high labial wire and to correct the distoclusion. The case was finished and retained by using Hawley retainers with bite plane which established the proper overbite.

Prepared for the American Board of Orthodontia.

During the treatment several muscle exercises were used as an adjunct to mechanical treatment. The patient was trained to swallow correctly in order to keep the tongue from resuming its faulty position. Exercises were prescribed

Fig. 1.—Case 1.

to strengthen the orbicularis oris muscles as well as a general tonic exercise for facial muscles. In the later stages the masseter-temporal exercise was employed in conjunction with the bite plane.

Case 3.—T. B., seven years old. It was impossible from the early history of this patient to discover any habits or perversions of function which might

contribute to the malocclusion, although this type is one which is usually attributed to such causes. Enlarged tonsils may have been a contributing factor.

When first examined the deciduous incisors were present in linguoversion but were so loose that they were removed before the impression was taken.

Prognosis.—Early correction is important in these cases in order to restore normal function and when established with a good overbite the prognosis is good.

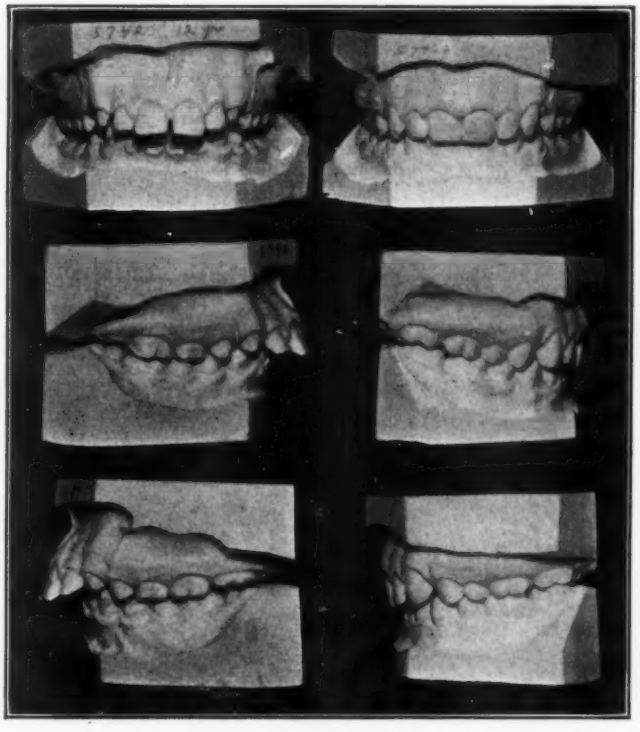

Fig. 2.—Case 2.

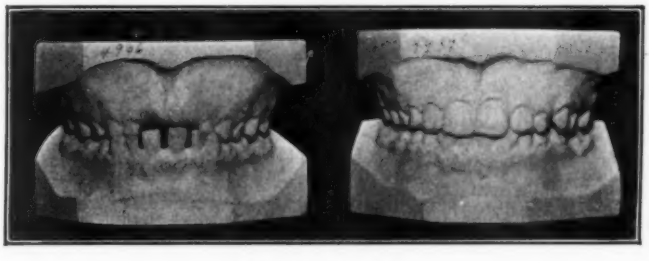

Fig. 3.—Case 3.

Diagnosis.—Neutroclusion with linguoversion of maxillary incisors. Labioversion of mandibular incisors.

Treatment.—A short lingual wire was adjusted and ligated to $\overline{2\text{-}1 \mid 1\text{-}2}$ to retract them. As $\overline{2\text{-}1 \mid 1\text{-}2}$ erupted, they were guided to position by means of a lingual wire with delicate finger springs.

Masseter-temporal exercises were given as soon as the incisors were in mechanical advantage. No retention is necessary in these cases, and, although

they must be kept under observation, it is expected that they will develop normally if no real growth disturbance is present.

Case 4.—P. J., thirteen years old. No predisposing cause could be obtained from the early history of this patient up to the age of eleven or twelve years. The posterior teeth erupted slowly, and at this time there was some difficulty in mastication owing to the extreme overbite and irritation of the gum tissue. The interruption in vertical growth in this type of case is sometimes attributed to a faulty calcium metabolism, and although the patient took plenty of milk and vegetables it is possible that the calcium may not have been assimilated properly.

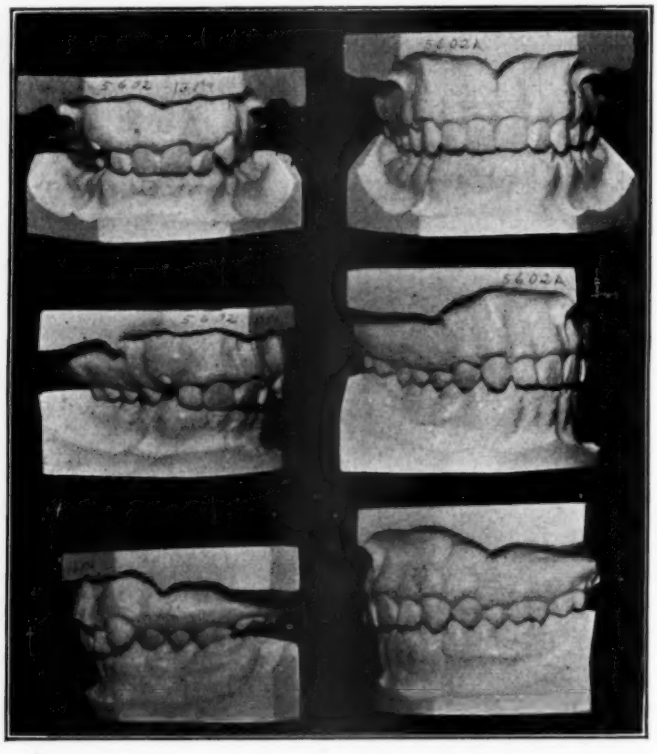

Fig. 4.—Case 4.

Diagnosis.—The malocclusion was diagnosed as distoclusion with posterior infraclusion of maxilla and mandible.

Prognosis.—The percentage of successful corrections of this type of malocclusion is reasonably good, but a great deal depends on the cooperation of the patient in the latter stages of treatment.

Treatment.—A lingual wire was applied to the maxillary arch to obtain a general development, and a basket bite plane was added later with supporting bands on the $\underline{4}|$ and $|\underline{4}$. The action of this appliance is to lengthen the maxillary arch while allowing for vertical growth in molars and bicuspids. The masseter-temporal exercise was used after sufficient general development was obtained, and a lingual wire with a labial Hawley attachment was used to develop the mandibular arch and to support the incisors.

As the mandibular arch was expanded, spaces appeared between $\overline{3}|$ $\overline{4}|$ and $\overline{5}|$ which were closed by drawing the posterior teeth forward by the use of the loop on the lingual wire. The final models show considerable expansion of both arches with the establishment of normal mesiodistal relation. The overbite is corrected and the curve of spee considerably reduced because of the vertical growth in the molar and bicuspid region. No intermaxillary force was applied in this case to correct the distoclusion, nor was any direct force applied to elongate or depress any teeth.

CASE 5.—L. E., sixteen years old. According to the available history, this patient had in early childhood been very delicate, sickly, and poorly nourished.

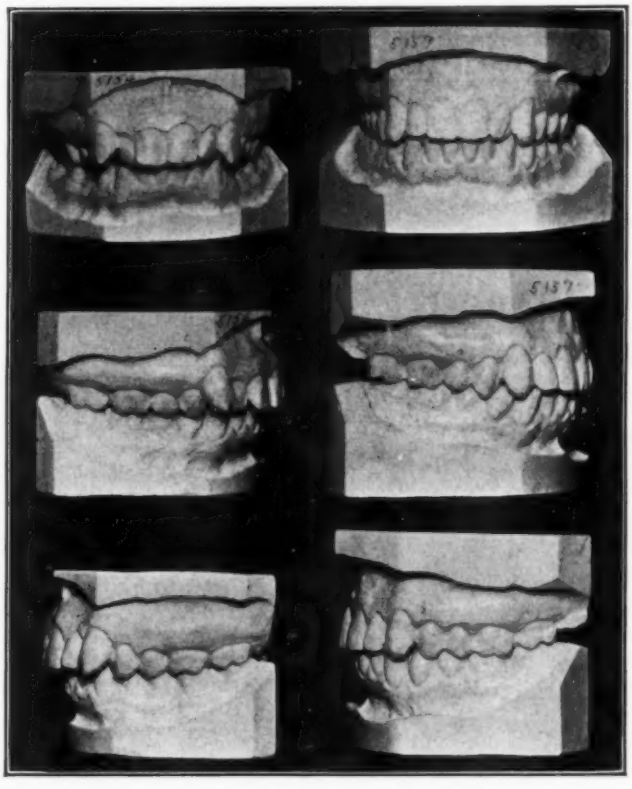

Fig. 5.—Case 5.

He had lost several deciduous teeth prematurely and had tonsils and adenoids removed because of nasal obstruction.

Etiology.—The premature extraction of $\underline{5}|$ $\underline{4}|$ allowed $\underline{6}|$ to drift mesially, causing a crowded condition of $\underline{3}|$ and $\underline{2}|$. This condition together with a contraction of the maxillary arch constituted an interference which forced the mandible into distoclusion.

Prognosis.—The prognosis in this case is reasonably good, as the well-defined cusps will tend to hold their normal relation when once established.

Treatment.—The arch form was obtained by the use of lingual wires with springs, and the distoclusion was corrected by muscle training without elastics. Exercises were also given to increase the tone in a very short upper lip as

well as a general tonic exercise. Hawley retainers and mandibular $\overline{3}|$ to $|\overline{3}$ were used as retention until the $\frac{8|8}{8|8}$ were extracted on account of slight impactions.

Result.—This case could probably be classified as a forced bite, since the removal of interferences made it possible to correct the distoclusion without either elastics or bite plane. The patient was interested in athletics and was willing to cooperate with the muscle training program, more especially to overcome what he termed a weak chin.

CASE 6.—R. W., thirteen years old. This case is that of a boy thirteen years of age. He had grown rapidly and was of slight build with poor muscular development. The history did not disclose any serious illness.

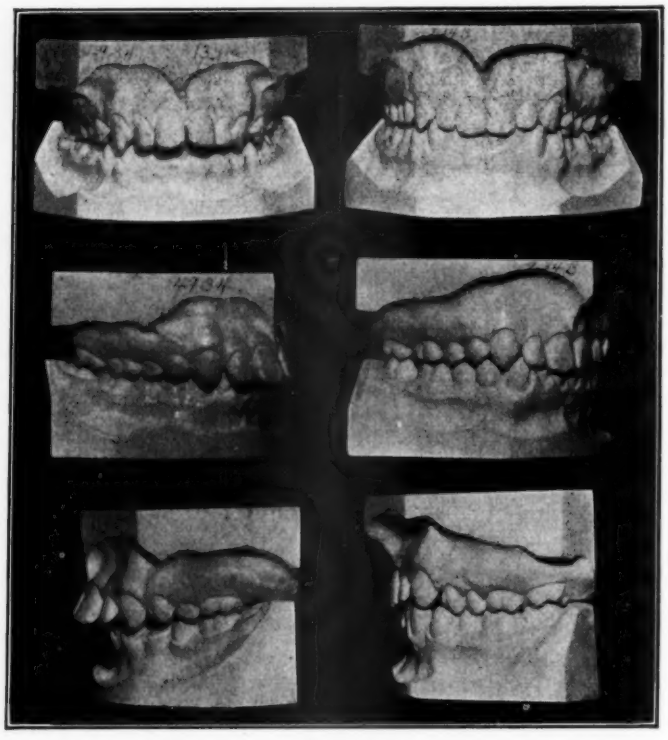

Fig. 6.—Case 6.

The cause of the malocclusion as presented was due at least in part to the lack of muscular development together with several habits which aggravated the condition. One factor which contributed to the distoclusion was the habit of resting the chin in the hand while reading. This was of some importance, as the patient spent much time with books. Added to this was a habit of drawing in the lower lip.

Prognosis.—The prognosis was considered only fair due to the poor muscular development of the body as a whole.

Diagnosis.—The diagnosis was distoclusion with linguoversion of $\overline{4}|$ and $|\overline{4}$. Anterior maxillary protrusion.

Treatment.—It was necessary to obtain considerable expansion in 3 | | 3 before attempting to correct the distoclusion. This was accomplished with a light wire appliance using 0.025 platinized gold wire and bracket bands on the cuspids. A high labial wire was used for a few months to retract 2-1 | 1-2 followed by an alignment wire with labial sections.

The mandibular arch was expanded by the use of a lingual wire, and a labial section was applied to flatten 2-1 | 1-2 and shorten the arch. The arch forms having been harmonized, a removable retainer with a bite plane was used to guide the mandible into normal position. A labial 3 | | 3 was used to retain the mandibular arch.

Myofunctional therapy was employed during the treatment with good effect. The pterygoid exercise was given early and continued throughout the treatment, but the masseter-temporal exercise was not prescribed until the cusps could be placed in mechanical advantage.

Exercises designed to strengthen the muscles of the neck were used to impart a better tone and to improve the posture. Attention was also given to the orbicularis oris and other facial muscles.

The general health of this patient has improved considerably, and the prospects of a permanent and satisfactory result seem better than was first expected.

GNATHODYNAMOMETER*

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THE construction and use of gnathodynamometers date back to 1681 when Borelli of Italy[1] devised and used an apparatus for measuring the forces exerted by the muscles of mastication in closing the jaws. That there has been a definite interest in gnathodynamics is manifested by the large number of gnathodynamometers constructed and used since Borelli's early work. There shall be no attempt made herein to describe these instruments, but those interested in descriptions and illustrations of the instruments are referred to the works of Haber,[1] Rowlett,[2] and Brekhus and Armstrong.[3] A general classification of gnathodynamometers according to construction, similar to Haber's, has been arranged in Table I.

TABLE I

WORKERS CONSTRUCTING VARIOUS CLASSES OF GNATHODYNAMOMETERS, WITH REFERENCE NUMBERS AND DATES OF PUBLICATION

CLASSES OF INSTRUMENTS								
I. SIMPLE LEVER			II. SPRINGS (HELICAL, LEAF, AND ELLIPSOIDAL)					
REF.	WORKER	YEAR	REF.	WORKER	YEAR	REF.	WORKER	YEAR
1	Borelli	1681	7	Dennis	1893	1	Dietz	1920
4	Sauer	1891	8	Patrick	1894	1	Hurthle	?
1	Rosenthal	1895	9	Black	1895	13	Ono	1921
5	Eckermann	1911	10	Head	1906	1	Christianson	1923
6	Gysi	1921	11	Johnson and Hatfield	1917	14	Friel	1924
			12	Robin	1918	1	Haber (second)	1926
			1	Morelli	1920	1	Haber (third)	1926

CLASSES OF INSTRUMENTS								
III. LEVER AND SPRINGS			IV. LEVER, SPRING, AND MANOMETER			V. MICROMETER (STEEL BALL IMPRESSION)		
REF.	WORKER	YEAR	REF.	WORKER	YEAR	REF.	WORKER	YEAR
1	Gunther	1920	1	Arnone	1906	1	Schonwald	1920
1	Haber (first)	1919	1	Dieck	1909	1	Gunther	1920
1	Hentze	1917	1	Hurthle (first)	?	1	VonKohler and Etling	1927
1	Pfaff	1925	1	Schwander and Lichteig	1919	15	Schauman	1935
			3	Brekhus and Armstrong	1936			

In 1934 a study of oral disease in school children was begun which included an investigation as to whether or not the force which the muscles of mastication were capable of exerting was related to the incidence of caries. To measure

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this force an instrument was necessary which was accurate and at the same time easily and rapidly manipulated. After reviewing the literature on gnathodynamometers and finding no instrument available that was suitable, an instrument of the lever-spring principle was constructed according to our specifications.

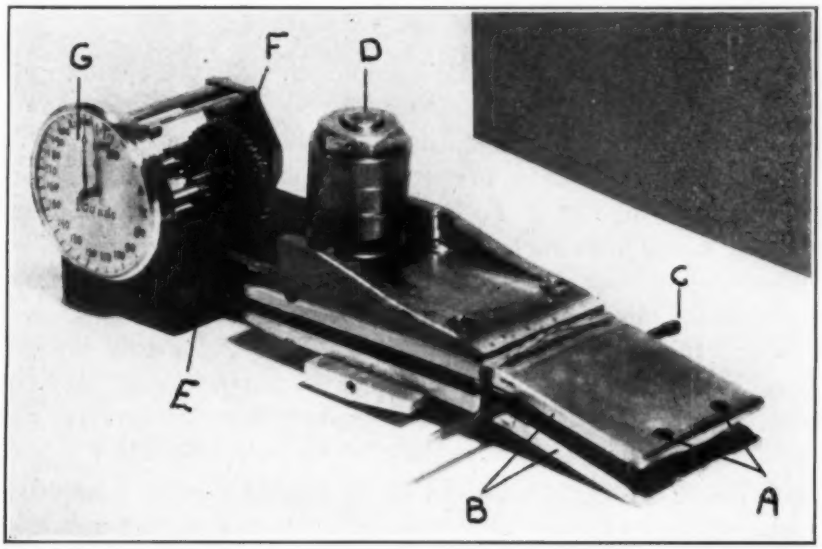

Fig. 1.—Instrument with housing removed: *A*, holes for insertion of bite plate pins; *B*, levers; *C*, nail in position of fulcrum; *D*, encased helical spring; *E*, rack; *F*, gear and pinions; *G*, gauge.

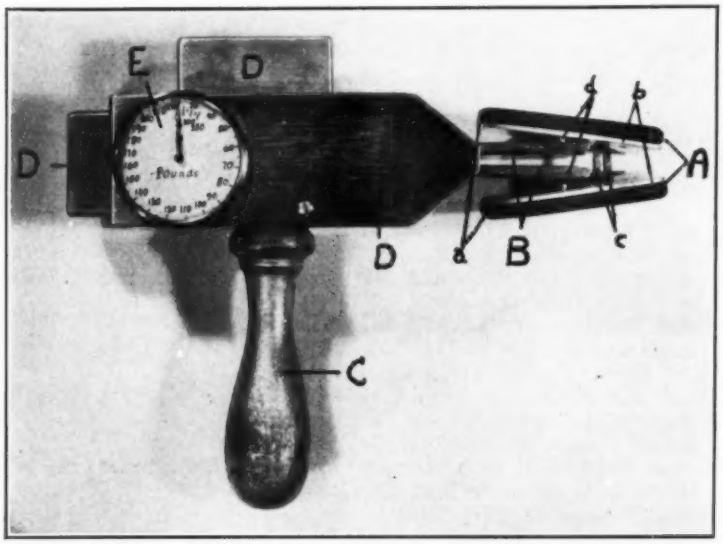

Fig. 2.—View of gnathodynamometer: *A*, bite plates; *a*, rubber pads; *b*, steel plates; *c*, springs; *d*, lugs; *B*, levers; *C*, handle; *D*, housing; *E*, gauge.

The following is a description of the gnathodynamometer constructed for us by Mr. Paul John, instrument maker, physics department, University of Rochester.

Fig. 1 shows the instrument with the housing removed. The holes, *A*, in levers, *B*, are for the insertion of short pins on the undersurfaces of the bite

plates (*A*, Fig. 2). The nail, *C*, is shown in the position of the fulcrum which is part of the housing. Pressure applied on the bite plates is transmitted by the upper lever, which is movable on the fulcrum, to the helical spring, *D*, which it compresses. A rack attached by a short arm to the upper lever moves upward with it and engages the pinion and gear system, *E*, which in turn rotates the pointer of gauge, *F*, registering in pounds the pressure applied at *A* through the bite plates.

Fig. 2 shows the instrument in its housing, *B*, and with the bite plates, *A*, attached. The bite plates are of three different sizes in order to accommodate the various sized arches. The bite plates using the ends of the levers, *B*, as fulcrums may move up and down, thereby permitting an adaptation of their surfaces to the occlusal plane of the teeth. To protect the teeth, rubber pads, *a*, cover the steel bite plates, *b*, and are attached by means of short screws. On the undersurface of each steel bite plate are: two short pins (not shown in the illustration), centrally placed, for insertion into the holes (*A*, Fig. 1) in the levers as a means of attachment; two small helical springs, *c*, attached to the steel bite plates by screws, to hold the bite plates together and in place, and to permit an up-and-down movement when force is applied to them; two lugs, *d*, to prevent a sidewise displacement of the bite plates when in use.

The bite plates are easily removed for sterilization or they may be left in place and sterilized by placing the entire end of the instrument in a solution of alcohol.

Determinations resulting from the use of this instrument are in progress and will be reported in the near future.

We wish to express our sincere appreciation to the Beech-Nut Packing Company for the grant under which this work is being conducted.

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WHAT DOES P. H. D. MEAN TO YOU?

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P H. D. What does it stand for, and how shall we interpret it? To some, Ph.D. means a degree, the symbol of a goal or milestone in their individual progress. To others it means Public Health Dentistry. How are we going to interpret it? Will it be Professional Help, or Political Hazard? The answer lies in the thoughts and actions of our dental organizations. Dr. Thaddeus P. Hyatt in one of his papers pointed out that the thoughts and actions of any group are the sum total of the thoughts and actions of the individuals composing that group.[1] If this is true, then the thoughts and actions of our dental societies toward the subject of Public Health Dentistry represent the collective expression of the individual members of the profession on this subject. Just as it is of vital importance to each one of us as individuals, to the same extent are our individual actions important to the good and welfare of our profession and to the health of our community. The control and regulation of our community program lie within our grasp if we as a group will but make the necessary intelligent and constructive effort to formulate a practicable, workable plan. If, however, our attitude is one of indifference or mere destructive criticism wherein P.H.D. will merely symbolize Profession Hold Down, then we will also be spelling our own doom, and the formula will represent Political Hazard to Dentistry.

Events are moving rapidly. We are living through a period of rapid social and political readjustment. If our profession is to retain its dignity, position, and professional characteristics, it must lead—not follow. In the course of evolution the species that succeeds in perpetuating itself is the one which first accomodates itself to a changed environment; the others have to wait for the scientist's spade to turn them up a million years later and say: "This must be the missing link." The moral is, Keep up with the leaders, or be a missing link.

Dr. H. S. Mustard in his book on public health says: "The extent and manner in which society concerns itself as to the public health depends upon the social philosophy which prevails."[2]

It is my hope that the full significance of that statement is realized. A changing social philosophy is one of the outstanding characteristics of most of our governmental actions today, as well as the source of much of our industrial unrest. It hardly seems necessary to point to Detroit or Lansing to emphasize the fact that organized labor is in the saddle these days. Whether it is riding to a well-earned place in the sun or merely riding to a fall, depends on whether its activities are being guided or misguided. Time will tell, but in the interim we must not forget that in all socio-economic upheavals there is a ruthlessness to the activating force which is better directed than blindly opposed.

In New York State we already have our Social Security with its Old Age Pensions and Job Relief, and the next most probable step will be some form of health insurance. In support of this statement let me quote James Bossard, noted sociologist, who says: "If unemployment is the most bitter, and old age the most pathetic, certainly sickness is the most common and disabling of the misfortunes which befall the average member of society."[3] The McCall Bill proposing a tax on tobacco to support free dental clinics for children in New York State, while unwisely worded and impractical in its present form, is certainly an indication of a growing *political* interest in dental health. As far as I am aware, organized dentistry was not consulted in the planning of this bill; and, when we oppose its passage as it now stands, our opposition can be very easily misrepresented as being a purely selfish, unsocial attitude on the part of the dental profession.

Why are we not consulted? Largely because we have no practical plan to offer; or, if we have, no one knows about it.

True, Socio-Economic Committees, and Clinic Committees have been appointed by various district groups. These committees have worked hard. Clinics and their faults have been investigated; the financial status of various groups, both dental and lay, has been discussed; the various alphabetical relief projects have come in for their share of condemnation; but what has been offered as a *workable* substitute? A report of one such committee—and a very active one it is—came to my office the other day. They had condemned the McCall Bill; deplored the activities of certain hospital out-patient departments; questioned the legality of a privately operated health service; orated against the W. P. A. —and then adjourned about midnight apparently because they could not agree on what to tear apart next. Now to what extent would such a report help you or me if we were called on tomorrow to plan a dental program representative of the opinion of the dental profession of New York State? I am not belittling their activities nor questioning their motives, but it is to be regretted that nothing more constructive has been produced after so much effort.

In May of 1930, Franklin D. Roosevelt, then governor of New York, appointed a Special Health Commission "to study and report upon the administrative and legislative aspects of public health in New York State. It also was requested to take into consideration the activities of state and local health authorities and their relations one to another, the recent progress in public health in other states and abroad, and to examine critically the extent to which the health needs of the people were being met."[4] It was my privilege to be a member of the Dental Committee serving that Commission, and the report and recommendations of that Committee may be found in "Public Health in New York State," published in 1932.[5] Unfortunately an economy program prohibited the carrying out of the recommendations despite the fact that they met with the approval of both the Commissioner of Health and the Governor.

Much water has passed over the dam since 1932; great economic and political changes have taken place; and some of us may have altered and broadened our concepts of a well-rounded dental program; but it is a healthy sign that again the State Dental Society has a committee, originated, I believe, during the recent administration of Dr. McNeely, to cooperate in building a State Dental

Health Program. It is up to us to help them all we can by thinking and planning with a social-mindedness, the most ideal and yet practicable program that has ever been worked out for the people of any state.

With this thought in mind let us ask ourselves, what should be the ideal goal toward which we are to strive? Should it be merely the establishment of dental clinics? Should the program be preventive, remedial, or educational? What part can we as individuals play in a program? What part must be played by the local dental societies? In other words, here is a task—how can we best do it, and what should be our ideal objective.

The ideal objective of a program of community mouth hygiene should be "the adoption of such salutary oral practices as contribute to the preservation of the health of the community."[6] True, this objective is very broad, but it must be broad if it is to be really inclusive. To work toward such an objective means bringing to bear on the problem the activities of the Department of Education, the Department of Health, the State and District Dental Societies, and the cooperation of the individual members of the profession, all working toward the common good. It seems ideal, certainly, but perhaps we can show that it is also practical.

Before considering a concrete plan which approaches our objective as the ideal, we must first study the outstanding characteristics, qualifications, and requirements of any good existing dental health program.

We find that there are two readily recognizable types of program current today: the educational program and the service type of program. Although almost invariably these are used as separate and complete entities, they are actually quite dependent one on the other if true accomplishment is to be expected.

Let us briefly define these two phases of a well-balanced program before we compare or discuss them.

The educational type is that form of dental program which is conducted in the class room and is primarily concerned with the establishment of a desirable hierarchy of habits relative to mouth hygiene, the inculcation of proper ideals of dental and general health, and the acquisition of authoritative information on dental health through the efforts of the class room teacher and the dental hygiene teacher.

An excellent example of this type is the work of the dental hygiene teachers in the Nassau and Westchester County Schools.

The service program concerns itself primarily with the rendering of preventive operative dental service in clinics. A certain amount of instructional work may or may not accompany this service.

The fine work being done by the New York City Department of Health clinics is an excellent example of a high type of service program. Service is, of course, limited to indigents, but conforms to the highest standards of good complete operative dentistry.

I very thoroughly agree with a statement relative to operative service that is made by Dr. Floyd E. Hogeboom: "I have noticed that in some dispensaries there is a tendency to disregard anything but 'emergency restorations.' Strictly speaking there is no such thing as an emergency restoration in dentistry. The

surgeon does not cut off fifteen cent's worth of appendix and then have the patient come back later for more. A dental lesion is an emergency as soon as it first becomes manifest. So in health center or dispensary clinical work it is every bit as important to start at the foundation and build up the work correctly as it is in private practice.''[7]

Each of these two types fills a very definite need in a community program, and they complement each other to form a *complete* program.

The educational program, of course, may succeed without the aid of the service program, whereas the service program *unaided by the educational* succeeds only in perpetuating itself. A service program, as its title would indicate, serves the mouth, but does little to change the habits, desires, or mental attitudes of the patient.

In considering this statement let us not forget that we are measuring the success of a program in terms commensurate with the stated objective; namely, ''the adoption of such salutary oral practices as contribute to the preservation of the health of the community.''

Bearing this in mind it is readily conceivable that an educational program with proper cooperation by the profession might very well bring about advantageous changes in the oral practices of the children of a community. Published evidence supporting this statement may be found in the dental literature. I refer especially to the programs being so successfully carried out in Floral Park, Long Beach, Valley Stream, and other Nassau and Westchester County schools, and for a time in five Brooklyn and Queens schools.[8]

There is one point relative to the two types of program that has been emphasized before but is so important that it will bear repeating: *''The weaker the educational program, the greater the demand for a service program.''*[6] In planning any community program, that statement should be given very careful consideration.

Having very briefly compared the characteristics and possibilities of these two types of work, and having set up a broad major objective, let us return to some of the questions mentioned earlier in the discussion.

Should our objective be merely the establishment of dental clinics? Obviously the answer is a most emphatic NO. The educational phase must enter into a complete program, otherwise you are serving the individual rather than the community.

Should the program be preventive, remedial, or educational? Some part of all of these if our ideal objective is to be reached. The operative program must stress preventive work—careful attention to all pit and fissure defects, and special emphasis on the lower age groups. We must consider the importance of the lower age groups not only from the clinical point of view as to the amount of good we are doing, but also from the administrative side in regard to the time consumed per patient. Dr. J. M. Wisan has conclusively shown in his work in New Jersey that: ''Starting at the eleventh year, the time and number of operations increase. The average of the fifteenth year group required more than twice the time required by the average of the sixth year group for completion.''[9]

What part can we as individuals play in a program? and *What part must be played by the local dental societies?* Perhaps these two questions can be best answered by saying that no public health program can be successfully carried out without the wholehearted and active cooperation of the profession. There should be in every program a very definite task for the professional groups as well as for the individuals. A carefully thought out program could include enough activities for the local societies to take care of their scientific programs alone for a considerable period of time.

For instance, we shall suppose that a child is sent to his family dentist through the efforts of a hygienist working in an educational program. The child is seven years of age and in need of dental attention. A note is returned to the effect that the trouble is only in the baby teeth and it is a good plan to let them decay so the germs will have something to eat and thus will let the permanent teeth alone. Sounds ridiculous? Well it actually happened. Let us take the case of little Tony. Tony was about nine years old. When I saw him he had a mandibular left second deciduous molar badly infected and sufficiently exfoliated that it was lying horizontally, with a partly resorbed root scratching his cheek. Unfortunately I saw him in a class room—not a clinic—or the story would have been different. We convinced Tony and his mother—who spoke almost no English—of the necessity of going immediately to their dentist and paying to have that tooth removed. Three days later Tony came back to the hygienist still in possession of his loose and infected tooth, but with a note from the family dentist stating that this being a baby tooth it would fall out anyway, so he had not performed the extraction.

Can you see the possibilities, then, of work for an active, cooperating dental society?

Most of the blame for the shameful neglect of the child patients which has been so current in the private offices goes back to the inadequate training in dentistry for children that we received at school. That is something which can be remedied by the local dental societies through postgraduate courses or special lectures.

A good state program might well make provision for cooperation with local or district societies in the matter of giving postgraduate courses in dentistry for children.

We spoke of the place occupied by education in our program. There is also a necessity for parental, as well as for professional, education. Another opportunity is thus presented for dental society activity. Most of our local societies have oral hygiene committees. A properly rounded program would include a certain amount of lay education through the activities of these oral hygiene or public relations committees. This type of educational work falls naturally within the scope of the dental societies, especially as it is more of a promotion campaign than an educational program.

As all of you are aware who have worked with the educational group, there is a sad lack of dental source material for teachers. If a teacher or a hygienist wishes to prepare a class room lesson on mouth hygiene, she either has to wade through great quantities of irrelevant and often out-of-date dental literature to secure her factual material, or else has to turn to the various leaflets distributed

by tooth-paste manufacturers, in which case there is always the danger of the content being biased to influence the purchase of a product. So another society cooperation might take the form of preparing authoritative source material for educational use. If this was too great a task, at least a well-informed committee could list such commercially sponsored booklets as were acceptable for use.

As for our individual opportunity for cooperation, suppose we stress just one. Do to the child who is sent to your office, what you would want done to your own child. Do not sign O.K. slips unless in your honest opinion the child *is* O.K. Every time we falsely sign a child's completion note we are paying that child's bill of health with a rubber check, and sooner or later it is going to bounce back at us. The public has to judge the honesty of our entire profession by the conduct of its known individuals. The hygienist or the dental hygiene teacher in a school is our greatest liaison agent. She eases the way from the class room chair to the dental chair. If we fail in our duty toward the child, we are untrue to her, to the government which is striving to help its citizens, to the child, and to ourselves. In defense of our negligence excuses are many, but reasons are few.

That we may leave with something constructive to think about, permit me in conclusion to summarize briefly:

1. The need for adequate dental service for our children is going to be met.
2. The need must be met and the means controlled by the dental profession, or the dental profession will be controlled by the means.
3. If the profession is to control the situation it must be prepared to meet it with a definite workable program.
4. Such a program should include the following:

Educational phase to consist of:

1. Fundamental educational program in the elementary and secondary schools in mouth hygiene, suitably integrated with other subjects of the curriculum.
2. Accredited summer school courses in the essentials of mouth health for teachers, nurses, and other school workers interested.
3. Accredited courses of study in the normal schools covering the essentials of mouth health.

Service phase to be entirely under the direction and guidance of the Health Department as to policies, and acting with the advice of the dental profession. Any cooperating agencies would of necessity have to conform to these policies.

Professional Activities:

1. Through the use of the county or district societies, the offering of post-graduate courses in dentistry for children.
2. Issuance of certificates of proficiency to members completing the post-graduate courses.
3. Cooperation with the Department of Education in the preparation of source material in dental health for teachers.
4. Preparation by professional groups such as Oral Hygiene Committees, Public Relations Committees, etc., in collaboration with the educational groups of dental educational material for lay consumption.[6]

The program just outlined, covers, I believe, every point which I have discussed, and in a practical way. May I close then with this thought:

A good thing to remember,
And a better thing to do,
Is to work with the Construction Gang
And not with the Wrecking Crew.

Now, what does P. H. D. mean to *you?*

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PRELIMINARY REPORT ON LOCAL USE OF SULFANILAMIDE IN TREATMENT OF ORAL LESIONS

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PARA-AMINOBENZENESULFONAMIDE (sulfanilamide or prontylin), a dye recently introduced to the medical profession, has been found effective in the treatment of a group of infections in which the beta-hemolytic streptococci plays an important part.

Long[1] employed this drug in ten patients with streptococcal meningitis at the Johns Hopkins Hospital. With intensive therapy eight of this group recovered. Considering the known mortality of the disease, the percentage of recovery is far too large to be attributed solely to chance. (In the 37 previous available cases, records of the Johns Hopkins Hospital, no recoveries from this infection have been noted in the last fifteen years.)

Weinberg, Mellon and Shinn[2] report the successful treatment with sulfanilamide of two patients severely ill from this infection.

Schwentker and his coworkers[3] in reporting the recovery of three out of four patients with meningitis state that "Sulfanilamide is probably a specific chemotherapeutic agent for meningitis caused by beta-hemolytic streptococci."

Snodgrass and Anderson[4] state that the use of sulfanilamide is advisable in the treatment of erysipelas.

Peters and Howard[5] report that the spread of the disease was arrested in twenty-four hours in all 47 cases of erysipelas they treated with sulfanilamide and that in 31 cases the temperature was normal within forty-eight hours.

Breen and Van Taylor[6] draw attention to the fact that no spread of the disease or relapse occurred in any patient while actually taking sulfanilamide.

Long and Bliss of Johns Hopkins Hospital report several cases of scarlet fever in which the administration of sulfanilamide was followed by remission of the fever with a rapid decrease of glandular enlargement and of the infection of the ears. In a serious case with double otitis, the septic temperature which ranged up to 104° F. fell to normal in twenty-four hours and otitis cleared up in three days.

Read before the Florida State Dental Meeting, Hollywood, Florida, Nov. 4, 1937.

Long and Bliss also report striking results from the use of sulfanilamide in the treatment of puerperal sepsis. Marked clinical improvement occurred promptly after the administration of sulfanilamide; however they suggest that the treatment be started as soon as possible after the infection is discovered, as clinical evidence shows the time factor to be important.

Colebrook and Kenny[7] after treating 38 cases of streptococcal puerperal fever with sulfanilamide concluded that "there is more hope for controlling streptococci infection by this therapy than by any other means."

Foulis and Barr[8] treated 22 cases of puerperal sepsis over a three-month period with sulfanilamide. The success they achieved was marked by a rapid and striking fall in temperature and general improvement.

Bohlman[9] used the product in mixed infections of streptococci and hemolytic staphylococci, also in one case of *Staphylococcus aureus* infection, all with excellent results. Bohlman reports cases of gas gangrene in which he regards the results as amazing. He is convinced it will be of great value in saving life and limb. He states: "Sulfanilamide probably has a specific effect on gas bacilli but the results may in part be due to checking symbiotic growth with the streptococcus."

Long (quoted by Bohlman)[10] in conducting experiments with the *B. welchii* believes that phagocytosis is not inhibited or enhanced by this drug, that it acts directly to inhibit the growth or multiplication of these bacilli and that its mechanism of action on other bacteria is similar. He states that a prophylactic effect has been noted whenever it has been used therapeutically in experimentation. He suggests that prophylactic doses be given in all severe or crushing injuries in which infection with streptococci gas bacilli might subsequently occur.

Weiser[11] after using sulfanilamide for one and one-half years successfully in the treatment of urinary tract infections, concluded that sulfanilamide usually produces its full effect in two or three days, but that in some cases where the drug had failed in the first two or three days, interruption of treatment and its subsequent renewal a little later were followed by success.

Long and Bliss[12] remind us that if the drug is discontinued too soon there may be a reoccurrence of the streptococcic lesion. They state: "When one is dealing with mild acute streptococcic infections recovery after the administration of para-aminobenzenesulfonamide or its derivatives is generally so prompt that it seems safe to decrease rapidly the amount of the drug administered. In mild chronic infections due to beta-hemolytic streptococci, such as chronic impetigo and chronic otitis media, it is often necessary to administer the drug over a rather long period or until a definite clinical and bacteriologic cure is effected.

Patterson,[13] after treating over one hundred cases of erysipelas, scarlet fever and streptococcal meningitis with an oral and hypodermic dosage of sulfanilamide, reported that his results were favorable and in some cases spectacular. He also reported that over 200 cases of scarlet fever were treated at Englewood Contagious Disease Hospital. These patients showed a loss of fever in thirty-six to forty-eight hours, rapid fading of the rash, greatly reduced

peeling and reduction in number of complications. Applebaum reporting for the Meningitis Commission stated that in 256 cases in which sulfanilamide was not used only 15 recovered, while in 12 similar cases in which sulfanilamide was used nine recovered.

In the Babies Hospital of New York City favorable results were found in the treatment with sulfanilamide of erysipelas, bacteremia, primary peritonitis, and mastoiditis. At the New Haven Hospital sulfanilamide was used in 60 cases against the beta-hemolytic streptococcus infection with favorable results in the treatment of erysipelas, pneumonia, meningitis, mastoiditis, otitis media, sinusitis, tonsillitis, cervical adenoiditis and scarlet fever. Some toxic effects, however, were experienced by a few patients in the form of cyanosis, fever, or a rash. "The Di-Na salt (prontosil) has been discarded because crystallized sulfanilamide is more effective, cheaper and more convenient."

Purdie[14] reports a case of chronic wound infection following puerperal sepsis. Sulfanilamide by mouth and local treatment with the same drug were followed by sterilization of the wounds within three weeks and complete healing within six weeks.

Neal and his associates[15] report that of 12 patients suffering with streptococcic meningitis 9 recovered with sulfanilamide therapy, while Thompson[16] reports a similar case of a six-year-old girl treated successfully with sulfanilamide. Cyanosis occurred but the dosage was continued on the advice of Dr. P. H. Long of Johns Hopkins Hospital, and the cyanosis became less despite the large doses of sulfanilamide.

Buchtel[17] of the Mayo Clinic reports that sulfanilamide has been used in over 200 cases of urinary infections, including gonorrhea, and has been found a more potent urinary antiseptic than mandelic acid. He says further that sulfanilamide has proved greatly superior to any other antiseptic in prostatitis, in urinary infection associated with prostatitis, and in gonorrhea.

Prompt and spectacular therapeutic results in 20 to 25 per cent of the cases of gonorrhea treated with sulfanilamide have been reported by Day.[18] In the next 25 per cent, the results were definite and decided, while in the other cases the effectiveness of sulfanilamide therapy was difficult to determine. Day used a dosage of about 40 grains per diem except for desperate cases, when he used a heavier dosage. He recommends the use of a small dosage at first, followed by an increasing dosage, rather than a heavy original dose. He concludes that with a moderate dosage he has experienced no toxic effects and no blood dyscrasias have occurred.

Kenny and his associates[19] report the recovery of 46 patients with *B. coli* infection of the urinary tract, including 16 cases of pyelitis of pregnancy, 17 of urinary tract infection in the puerperium, 9 of pre- and post-operative urinary tract infection, 2 of pyelitis and 2 of cystitis outside of the obstetrical ward. Sulfanilamide was found cheaper, more effective, and more rapid in action and better tolerated by pregnant women than mandelic acid.

Helmholz[20] found that sulfanilamide produced a urine that is strongly bactericidal for most of the organisms which cause infection of the urinary tract except *Streptococci faecalis*. He adds that sulfanilamide may be used

in the acute stage of the disease and is effective even in renal insufficiency and that it works best with an alkaline urine. Floyd and Pittman[21] state that their experience in genitourinary infections leaves little doubt in their minds that sulfanilamide is a drug of great value.

DOSAGE

In adults of 100 pounds or more, 10 to 16 five-grain tablets form the initial dose, which in about seven hours should raise concentration in blood to approximately 10 mg. per cent. Following the initial dose, 2 or 3 tablets at four-hour intervals should be given. Children weighing from 25 to 40 pounds should be given 4 to 6 five-grain tablets and 1 to 2 tablets every four hours. Dosages are changing continually, and Dr. Bohlman suggests that smaller initial doses may well be used; and he has found the following dosage very satisfactory: 80 grains for two days, 60 grains for three days, and 40 grains for eight days. With definite clinical improvement the dosage should be reduced.

TOXICITY

That sulfanilamide is not entirely without toxic manifestations is well recognized. Brown and Bannick[22] state: "Clinical experience with these toxic effects has led us to group them as mild, moderate, or severe. Mild toxic effects are: general malaise (which is the effect seen most frequently), headache, mild vertigo, tinnitus and nausea. Moderate toxic effects may include the foregoing together with cyanosis (methemoglobinemia, which is noted quite frequently, or sulphemoglobinemia), numbness and tingling of the hands, face, or feet, skin manifestations (erythema multiforme, a rash resembling measles), abdominal pain, diarrhea, fever, acidosis and a toxemia resembling that of ethyl alcohol. Severe toxic effects frequently consist of the foregoing and in association with: (1) a picture of severe toxicity, collapse, fever and rapid pulse; (2) leukopenia or agranulocytosis; (3) hemolytic crisis; and (4) jaundice."

Harvey and Janeway[23] report three cases of acute hemolytic anemia following the use of sulfanilamide.

Borst[24] lists a death from agranulocytosis following use of this compound.

Since sulfanilamide or its derivatives contain the benzene ring, it is possible that it may cause damage to the hematopoietic system.

In a personal communication, Dr. Kracke of Emory University states: "I believe it is now fully established that the benzene ring in sulfanilamide is responsible for the complete agranulocytosis seen in an occasional patient after the administration of that drug by mouth. No doubt it is also responsible for the partial degrees of neutropenia that occur after the administration of the drug. In my opinion this action is due to the presence of the benzene ring with the NH_2 attachment that serves as the central nucleus for this compound. So far as I know in every instance the eight or nine cases of agranulocytosis that have followed the use of this drug have followed the oral administration and not the injection of the drug. Therefore, at the present time it is my opinion that so far as the blood is concerned the injectable preparation is safer than the oral."

Sulfanilamide is indicated in many oral infections but should never be given without the advice and cooperation of a physician. The local use is without toxic manifestations, and the drug may be used in many conditions without fear of complications. During the past seven months we have used this chemical routinely in all infections except Vincent's with results as dramatic as those reported in the medical journals.

In April, 1937, we first used sulfanilamide in a "dry socket," placing one-half of a five-grain tablet in the socket. The patient had experienced the familiar pain with loss of sleep. The next day the patient reported a restful night, free of pain. Since then we have extended its use following all operations in infected areas and in all areas where we anticipated infections following operations or injuries. Following the surgical treatment of pyorrhea powdered sulfanilamide is placed in the wound before the protective pack is applied. Immediately following the extraction of a tooth, a mixture of tricalcium phosphate 3 parts, calcium carbonate 1 part is mixed into the blood in the socket; this immediately controls hemorrhage, besides supplying a local source of calcium to rebuild new bone.[25] This is followed by placing either a portion of a five-grain sulfanilamide tablet or powdered sulfanilamide into the blood clot. Postoperative pain is controlled and the lesion heals without complications. No drug is required for the relief of pain in dry sockets and following the removal of impacted teeth, as the sulfanilamide in some way corrects or prevents pain.

An interesting case of a patient with an infected compound fracture of the mandible was treated successfully by the local application of the drug. The patient had fever, and much pus was present. We placed a half tablet into the wound. The patient returned in forty-eight hours perfectly comfortable, no fever and no pus present. This treatment was continued twice each week until the lesion healed. No complication or discomfort was experienced.

A boy four years old was referred to us with osteomyelitis of the right mandible, temperature was 101°, much pus from the area of the first premolar. One-fourth of a five-grain tablet was worked into the infected area. In twenty-four hours the temperature had dropped to normal, with no visible pus present. This treatment was continued for a week. The mother failed to return the boy to the office for ten days, and upon his return a temperature of 101° and much pus were found. Treatment was again instituted with satisfactory results. For a period of forty-eight hours, however, during this time we did not see the boy, and his temperature again rose to 100°. Following the next treatment his temperature again returned to normal.

Several months ago we suggested the use of sulfanilamide to Colonel W. D. Lanier in charge of the clinic at the United States Veterans Hospital at Oteen, North Carolina. In a personal communication he states: "In our clinic, over a period of about six months, we have treated with sulfanilamide more than 100 cases where teeth were extracted for far advanced pyorrhea, one-half of a five-grain tablet of sulfanilamide being used in each socket. The same treatment was followed in the extraction of more than 250 cases of chronic periapical infection. Smears taken from these sockets at the time of extraction showed many cocci present, while smears taken twenty-four to forty-eight hours follow-

ing treatment with sulfanilamide showed only a few organisms and after three days no bacteria present. In these cases there was a marked decrease in the usual after extraction soreness, no pain, and no dry sockets."

We have used the drug in healthy tooth sockets; it does not interfere with normal healing. We are unable to detect any value of the drug in the treatment of Vincent's infection.

This report is a preliminary report, as our experience has been limited. Final conclusions must be postponed until a greater number of cases are reported.

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TEN YEARS' RESEARCH OF DENTAL INFECTIONS AND THEIR RELATIONS TO SYSTEMIC DISEASE*

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THROUGH the avenue of focal infection dentistry has established itself permanently in the hospital and is now recognized as a possible factor in the etiology of systemic disease. The physician realizes that the oral cavity may play an important part in the medical syndrome, and we, as dentists, must feel our responsibility for any infectious disturbance that may have its origin in the mouth.

Where does the greater part of our responsibility lie? It rests in diagnosis and treatment of periodontal diseases, carious teeth, especially those teeth with involvement of the pulp, and pulpless teeth. The dentist must determine what rôle oral infection plays in systemic disease if he wishes to carry out this work scientifically. Our first step then is diagnosis. In diagnosis we must thoroughly evaluate oral pathology and its metastatic manifestations.

DIAGNOSIS

Diagnosis is the art of distinguishing one disease from another. Clinical diagnosis is based on the symptoms shown during life irrespective of the morbid changes producing them. Differential diagnosis is the distinguishing between two allied diseases by contrasting their symptoms and physical signs. Direct pathologic diagnosis is made by observing structural lesions or pathognomonic symptoms. Diagnosis by exclusion is the recognition of a disease by excluding all other known diseases. Laboratory diagnosis is made by examination of various body fluids, secretions, and tissues in the laboratory. Physical diagnosis is the determination of disease by inspection, palpation, percussion, or auscultation. Topographic diagnosis is diagnosis of the locality in which a lesion is situated. Tentative diagnosis is a diagnosis based upon the available sources of information, but subject to change. Radiographic diagnosis is based upon interpretation of radiographs. We are thoroughly conversant with the fact, by now, that no dental diagnosis should be rendered without the dental and medical history and the radiographic findings.

The dental and medical diagnosis must be determined before operative procedure is instituted. It has been brought to our attention time and again that diseased teeth, suspected as being a focus of infection, were extracted without any resultant change in the patient's condition, and we have been severely criticized for having resorted to such methods. On the other hand, every infected tooth is a potential focus of infection irrespective of the patient's con-

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dition. These foci may remain latent for years, and frequently do, without causing any systemic disturbance; it therefore becomes difficult to convince the patient that such teeth should be treated or extracted, especially when there is no local or systemic disturbance. It has been my experience that in patients suffering from a systemic disease due to dental origin, there is generally a definite period between the time the tooth becomes infected and the first expression of a systemic sequela. This varies in different patients, depending on individual resistance and immunity.*

Patients suffering from any disease may have infected teeth and gingivae; it does not necessarily follow, however, that these oral lesions are responsible for the systemic disease. I dare say that in the majority of cases they are not, but nevertheless the infected teeth may be the underlying factor in preventing a more rapid improvement in the patient's condition. In all events we should weigh the dental and medical evidence before making a diagnosis.

When Dr. E. C. Rosenow of the Mayo Clinic advanced his theory of focal infection, he demonstrated that infected teeth and pyorrhea alveolaris can and do produce systemic disease. He advised that all pulpless teeth, even though radiographically negative, should be extracted. While I cannot support this extreme attitude, there is much to be said for the principles underlying Dr. Rosenow's deductions. We must remember, if I am not misquoting Dr. Rosenow, that root canal therapy is not practiced at the Mayo Clinic. In the presence of a systemic disturbance, due to dental foci of infection, they regard it as advisable to extract all pulpless and infected teeth. In our opinion, many pulpless and infected teeth if properly treated can be saved, even in the presence of a systemic disease.

To illustrate what can be accomplished with infected teeth in the presence of systemic disturbance, I am citing the following case. In 1916, I treated a patient who had two infected teeth and who also suffered from an arthritis of the wrist joint. The two teeth were treated at the request of a physician; a pure culture of a *Streptococcus viridans* was recovered from the apices of the root canals. The teeth were rendered bacteriologically sterile. Thereafter nine cultures were taken; the first was positive but all others were negative. The bacteriologic observations were carried over a period of nine months. The patient's recovery from the arthritis was ascribed to the dental therapy. The apical infection was cured without the necessity of extracting the affected teeth.

In September, 1932, this patient again complained of an arthritis. Her physician, being informed that two pulpless teeth had been treated for a similar illness sixteen years ago, advised their removal. The teeth were therefore extracted by me and carefully cultured. In spite of fourteen days of incubation no bacterial growth resulted. I do not want to infer that all infected teeth can be saved. In each instance the patient's medical and dental history must be considered before a decision is made in regard to the retention of infected teeth.

The case just reported shows that pulpless teeth harboring infection, even in the presence of systemic disease, can be retained if the proper root canal

*A. M. A. July 30, 1927. Dental Infections, Systemic Manifestations and Bacteriologic Observations.

therapy is pursued, that is, by checking on the bacteriologic findings and not filling these teeth until they are found bacteriologically negative. It also shows that infected teeth that are bacteriologically positive can be rendered sterile and remain sterile. I might state also that this work has been carried out on many patients. I do not want to be misunderstood, as I do not believe in retaining all pulpless teeth whether there is, or is not, a systemic disease. We must exercise discretion in each case.

CONSULTATION

The physician, when called upon to see a patient, after thoroughly evaluating the many symptoms may at times be in a quandary as to diagnosis. The medical picture may not be quite classical enough and the symptoms may be so vague that a tentative diagnosis is resorted to, until such time that some pathognomonic symptom presents itself. If he is in doubt as to the diagnosis he does not hesitate to consult a medical specialist, but rarely considers consulting the dentist. The question of a dental focus may not occur to him, or he may not believe that infected teeth could play a part in this medical syndrome. Under such trying conditions, the laryngologist, when consulted, would not hesitate to open a suspicious sinus even though not infrequently he may find it negative, whereas the dental picture may show many infected teeth with an old dental history.

DENTAL AND MEDICAL DIAGNOSES

It is not my intention to discuss the treatment of pulpless, abscessed or pyorrhetic teeth, but merely to stress their importance in diagnosis. Because a tooth is pulpless does not necessarily mean that it is harboring infection. I have treated many pulpless teeth, opened the canal mechanically passing a sterile probe to the apex, permitted a sterile cotton point to remain in the canal from forty-eight to seventy-two hours, removed the cotton point, and after four to seven days of incubation recovered no growth. This does not mean that all pulpless teeth are sterile for we know differently, but I firmly believe that, in root canal therapy, bacteriology should be part of the routine procedure if we wish to retain these teeth.

If a root canal harboring infection can be rendered sterile and will remain sterile, as shown above, I believe the tooth a good risk and recommend that it should be retained. If, on the other hand, the canal cannot be rendered sterile, I would consider the tooth a poor risk and advise its removal.

The dental and medical diagnoses should aid one in determining the question whether in the presence of a systemic disease pulpless teeth should be retained. We must not lose sight of the fact that there are other portals of entry of bacteria into the blood circulation besides infected teeth. We must determine whether the infected teeth are the primary or secondary factors in a metabolic disturbance or whether the teeth, although infected, have no bearing in the medical syndrome. We have seen patients who have had teeth extracted with no resultant change in their systemic disease. One should be very careful in rendering a diagnosis. The diagnosis should be made only after consultation with physician and dentist.

The following is a case which was rather disturbing to the physician and the dentist. A physician referred his father, a man seventy-five years of age, for dental treatment. The radiographs showed many infected teeth, although the patient had never complained of a systemic disturbance. I reported my radiographic findings to the physician and advised the retention of these teeth much to his astonishment. I felt that this patient had developed an immunity, and that if the teeth were extracted, there might be a flare-up from the latent focus. The physician agreed, and the patient retained his teeth, and lived to be ninety-four years old. I cite this case to show the importance of consultation between physician and dentist.

Mr. A. M., aged fifty years, was examined August 1, 1928. He had a marked pyorrhea. The maxillary anterior teeth from the left cuspid to the right lateral incisor had large silicate fillings. Radiographic examination showed periapical areas suggesting infection and marked pyorrhetic pockets. Prior to the dental examination the patient was treated for duodenal ulcer; he was confined to bed and received nourishment by tube for six weeks. He showed no improvement with this treatment. Another physician was consulted, who reported the following:

Patient suffered recurrent attacks of epigastric distress for seven years, occurring soon after meals, relieved by fasting or forced vomiting, accompanied by distention and slight impairment of appetite; there was occasional concomitant dull pain in the right upper quadrant. He was treated unsuccessfully for duodenal ulcer. Physical examination revealed well-nourished, middle aged man, with pupils reacting to light and accommodation, fundi negative, sinuses clear, many teeth missing, coated tongue, pharynx normal, heart regular and of good quality with no murmurs; lungs normal; liver palpable, otherwise abdomen negative; reflexes exaggerated, blood pressure 106/68; urine negative; Wassermann negative. Fluoroscopy showed slight widening of the aortic arch.

X-ray picture of the gastrointestinal tract revealed periduodenitis. Diagnosis was biliary tract infection with reflex pylorospasm.

The infected teeth were extracted; cultures from the roots showed nonhemolytic streptococcus gamma from which a vaccine was made and given over a period of three months; additional treatment included bile salts, belladonna, and neocinchophen. Patient was in good health after four months' treatment. Seven months after cessation of treatment, he reported in good health. Patient was again seen in April, 1937, and reported good health.

In cases of dental infection with systemic manifestations it is advisable to remove all dental foci, after which the patient is given a rest for at least four weeks. In many cases there is complete recovery from the systemic disturbance following the removal of infected teeth, while in others there is not. If the patient on his return does not show marked signs of improvement in his systemic condition, the use of an autogenous vaccine is indicated. Vaccines are administered by the physician. In no instance has the use of autogenous vaccines been followed by deleterious results.

Table I is a report of two hundred cases I have seen in my office over a period of ten years.

TABLE I

OFFICE CASES

CASE	NONVITAL TEETH	DENTAL DIAGNOSIS	MEDICAL DIAGNOSIS	ORGANISM	RESULTS	VACCINE
1	1 | 1-2	Infected teeth	Arthritis	Strep. V. Nonhem.	Good	Vaccine
4		Pyorrhea	Arthritis	Strep.	Good	
5	| 4	Infected teeth	Arthritis	Strep.	Good	
6	5 |	Infected teeth	Arthritis	Strep.	Good	
7	6 |	Infected teeth	Arthritis	Neg.		
8-9	2 |	Infected teeth	Iritis	Strep.	Good	
10	4 |	Infected tooth Cotton point	Arthritis	Strep.		
11		Pyorrhea	Arthritis	Strep. and Staph.		
12	4 |	Infected teeth	Arthritis	Strep.		
13	6 |	Infected teeth	Arthritis	Strep.	Good	Vaccine
14-15(6)	| 4-12	Infected teeth	Arthritis	Strep.	Good	
16	12 |	Infected teeth	Spondylitis	Strep.	Good	Vaccine
17	| 4	Infected teeth	Spondylitis	Strep.	Good	
18	| 5	Infected teeth	Spondylitis	Strep.	No	Vaccine
19	5 |	Infected tooth	Arthritis	Neg.		
20-21	5 | 5	Infected teeth	Arthritis and lues	Strep.	Good	
22-23(19)	| 5	Infected tooth	Arthritis	Strep.	Good	
24	1 | RT	Infected tooth	Arthritis	Strep.		
25-26(24)		Infected tooth	Arthritis	Neg.	Good	
27-28	4 | | 5	Infected teeth	Ulcerative colitis	Strep. faecalis	Good	Vaccine
29	12 |	Infected tooth	Lumbar paralysis	Strep.		
30-31		Pyorrhea		Strep. and Staph.		
32-33-34	6-12 | 4	Infected teeth	Cardiac	Strep.	Good	Vaccine
35	4 |	Infected tooth	Bursitis	Strep.	Good	Vaccine
36-37-38-40-41-42	12 | 12 4-5 | 5	Infected teeth	Hodgkin's disease	Strep.	No	Vaccine
39	| 12	Infected tooth	Arthritis	Strep.	Good	Vaccine
43	| 5	Infected teeth	Arthritis	Strep.	Good	Vaccine
44	6 |	Infected teeth	Arthritis	Strep.	Good	Vaccine
45	| 5	Infected teeth	Spondylitis	Neg.		
46	5 |	Infected teeth	Cardiac	Strep.	No	
47	1 |	Pulpless right tooth		Neg.		
48-49	4 |	Pulpless right tooth		Strep.		
		Three treatments		Neg.		
50	2 |	Pulpless		Strep.		
51	6 |	Pulpless		Neg.		
52-53-54	4 | 3-4 |	Infected teeth	Arthritis	Strep.	Good	Vaccine
55	| 5	Infected tooth	Arthritis	Strep.	Good	Vaccine
56	| 12	Infected teeth	Spondylitis	Strep.	Good	Vaccine

TABLE I—CONT'D

CASE	NONVITAL TEETH	DENTAL DIAGNOSIS	MEDICAL DIAGNOSIS	ORGANISM	RESULTS	VACCINE
57	| 5	Infected teeth	Cardiac	Strep.	No	Vaccine
58-59	| 5-6	Infected teeth	Arthritis	Strep.	Good	Vaccine
60	12 |	Infected teeth	Bursitis	Strep.	Good	
61-62	| 5-6	Infected	Myositis	Strep.	Good	
63	| 5	Infected teeth	Arthritis	Strep. and Staph.	Good	
64	5 |	Infected teeth	Gastritis	Neg.		
65	| 8	Infected teeth	Arthritis	Strep.	Good	Vaccine
66	3 |	Infected teeth	Lues and arthritis	Neg.		
67	| 4	Infected teeth	Sinus	Strep.		
68	4 |	Infected teeth	Arthritis	Strep.		Vaccine
69	4 |	Infected teeth	Sinus max.	Strep.		
70	| 4	Infected teeth	Myositis	Strep.	Good	Vaccine
71	| 4	Root canal inf.	Myositis	Staph.		
72-73	7-5 |	Infected teeth	Arthritis	Strep.	Good	Vaccine
74	| 5	Infected teeth	Arthritis	Neg.		
75	Smear	Gangrenous noma stomatitis		Many Vincent and fusiform	Died	
76	Smear	Pyorrhea	Cardiac	Strep.		
77	4 |	Infected teeth	Prostatitis and spondylitis	Strep.	Good	Vaccine
78	| 4	Infected teeth	Cancer of spine	Strep.		
79	Smear	Pyorrhea		Vincent strep.		
80-81	| 4	Infected teeth		Strep.		
82-83	7 | 6	Infected teeth	Arthritis	Strep.	Good	Vaccine
84-86-87	| 7	Infected teeth	Arthritis	Staph. and Strep.		
85-88-89	4 |	Infected teeth	Spondylitis Cancer	Strep.		
90	4 |	Infected teeth	Arthritis	Neg.		
91	5 |	Infected teeth	Arthritis	Strep.	Good	Vaccine
92-93	3-4 |	Infected teeth	Arthritis	Strep.	Good	Vaccine
94	| 6	Infected teeth, pyorrhea	Arthritis	Strep.	Good	Vaccine
95	Smear	Pyorrhea		Strep.		
96	Smear	Pyorrhea		Strep.		
97-98	4-6 |	Infected teeth	Iritis	Strep.	Good	Vaccine
99	6 |	Infected teeth	Arthritis	Strep.		
100	1 | 1	Infected teeth	Gastric ulcer	Strep.	Good	Vaccine
101	| 1	Infected teeth	Arthritis	Strep.	Good	Vaccine
102	1 |	Infected teeth	Arthritis	Neg.	Good	Vaccine
103	6 |	Infected teeth	Arthritis	Strep. and Staph.	Good	
104-106	| 2 | 3	Infected teeth	Arthritis	Strep.		Vaccine
105	Smear	Pyorrhea	Arthritis	Strep. and Staph.		
107	| 1	Infected teeth		Neg.		
108-109	2 | 8	Infected teeth	Duodenal ulcer	Strep.	Good	Vaccine

TABLE I—CONT'D

CASE	NONVITAL TEETH	DENTAL DIAGNOSIS	MEDICAL DIAGNOSIS	ORGANISM	RESULTS	VACCINE
110	$\overline{6}\vert$	Infected teeth	Arthritis	Strep.	Good	Vaccine
111	$\overline{6}\vert$	Infected teeth	Iritis	Strep.	Good	Vaccine
112	$\vert\overline{5}$	Infected teeth	Iritis	Strep.	Fair	Vaccine
113	$\overline{5}\vert$	Infected teeth	Mental	Strep.		
114	$\overline{3}\vert$	Infected teeth	Arthritis	Strep.	Good	
115	$\vert\overline{6}$	Infected teeth	Dermatitis	Strep.	Good	Vaccine
116	$\vert\overline{7}$	Infected teeth	Cardiac	Strep.	Good	
117	RC $\overline{7}\vert$	Infected tooth	Arthritis	Strep. and Staph.	10/26/29	
119	RC $\overline{6}\vert$	Infected tooth	Arthritis	Strep.	10/30/29	
118	$\overline{5}\vert$	Infected teeth	Spondylitis	Strep. and Staph.	Good	
120	$\vert\overline{5}$	Infected teeth	Arthritis	Strep.	No	
121	Smear	Pyorrhea		Vincent		
122	$\vert\overline{6}$ RC	Infected tooth	Arthritis	Strep.		
123	$\overline{6}\vert$	Infected tooth	Arthritis	Strep.		
124-125	Root canal 10/18/29	Same case as No. 117		Neg.		
126	Root canal treatment	Same Case as No. 123		Neg.		
127	Smear	Gingivitis		Strep.		
128	$\vert\overline{6}$	Infected teeth		Strep. and Staph.		
129	Smear	Gingivitis		Pus, blood cells, gram diplococci		
130	Smear	Pyorrhea		Diplococci Leptothrix		
131	$\vert\overline{3}$ RC	Infected tooth		Strep.		1/11/30
132	Same as above			Neg.		1/22/30
133	$\vert\overline{4}$	Infected teeth	Nephritis	Strep.		
134	$\overline{4}\vert$	Infected teeth	Cardiac	Strep.		
135	$\overline{6}\vert$	Infected teeth		Strep.		
136	$\vert\overline{3}$	Infected teeth	Arthritis	Neg.		
137	$\overline{5}\vert$	Infected teeth		Strep.		
138	$\vert\overline{7}$ RC	Infected tooth		Strep.		3/29/30
139	Same as above			Neg.		4/ 2/30
140	RC $\vert\overline{5}$	Infected tooth		Strep. and Staph.		
141	$\vert\overline{6}$	Infected teeth	Arthritis	Strep.	No	Vaccine
142	$\vert\overline{7}$	Infected teeth	Arthritis	Strep. and Staph.		
143	RC $\vert\overline{5}$	Infected tooth		Neg.		
144	Smear	Gingivitis		Diplococci		
145	Smear	Gingivitis		Vincent		
146	$\vert\overline{3}$	Infected tooth		Strep.		
147	Same case			Strep.		

TABLE I—CONT'D

CASE	NONVITAL TEETH	DENTAL DIAGNOSIS	MEDICAL DIAGNOSIS	ORGANISM	RESULTS	VACCINE
148	Smear	Gingivitis		Vincent		
149	|4 RC			Strep.		
150	|4	Same case as No. 149		Strep.		
151	4|	Infected teeth	Bursitis	Strep.	Good	Vaccine
152	|6	Infected teeth		Strep.		
153	6|	Infected teeth, pyorrhea		Strep. and Staph.		
154	|6	Infected teeth	Bursitis	Strep.		
155	5|	Infected teeth	Conjunctivitis	Strep.	No	Vaccine
156	|3	Infected teeth	Arthritis	Strep.	Good	Vaccine
157	3|	Infected teeth	Same as No. 156			
158	5-6|	Infected teeth	Cancer of spine	Strep.	No	Vaccine
159	6|	Infected teeth	Arthritis Same as 156-157	Strep.		
160	|8	Infected teeth	Arthritis	Strep.		
161-162-163	2-1| 6|	Infected teeth	Neuritis	Strep.	Good	Vaccine
164	6|	Infected teeth	Gastric ulcer	Strep.	Good	Vaccine
165	|3 RC	Infected tooth		Strep.		
166	Smear	Gingivitis		Vincent's		
167-168	3|1	Infected teeth	Cardiac	Strep.		
169	|1	Infected teeth	Gastritis	Strep.	Good	Vaccine
170	|5	Infected teeth	Gastritis	Strep.	Good	Vaccine
171-172	|5 |5	Infected teeth	Gastric ulcer	Strep.	Good	Vaccine
173-174	3-5|	Infected teeth	Arthritis	Neg.		
175-176	1-7|	Infected teeth	Conjunctivitis	Strep.	Good	
177	|2	Infected teeth	Duodenal ulcer	Strep.	Good	Vaccine
178	6|	Infected teeth	Arthritis	Strep.	Good	Vaccine
179	1|1-3	Infected teeth	Spondylitis	Strep.	Good	Vaccine
180	5|	Infected teeth	Arthritis	Strep.	Good	Vaccine
181	6|	Infected teeth	Arthritis	Strep.	Good	Vaccine
182-183	2|2	Infected teeth	Conjunctivitis	Strep.	Improved	Vaccine
184	|6	Infected teeth	Sacroiliac	Strep.	Good	Vaccine
185	4|	Infected teeth	Arthritis	Strep.	Good	Vaccine
186	7|	Infected teeth	Arthritis	Strep.	Good	Vaccine
187	3|	Infected teeth	Arthritis	Strep.	No	Vaccine
188-189	7-8|	Infected teeth	Cardiac	Strep.	Good	
190	7|	Infected teeth		Strep.		
191	|5	Infected tooth	Arthritis	Strep.	Good	Vaccine
192	5|	Infected teeth	Gastric ulcer	Neg.		
193	7|	Infected teeth	Same as above	Strep.	Good	Vaccine
194	|2	Infected teeth	Arthritis	Strep.	Good	Vaccine
195	8|	Infected teeth	Gastric ulcer	Strep.	Good	Vaccine
196	|5	Infected teeth	Arthritis	Strep.	Good	Vaccine
197	5|	Infected tooth	Arthritis	Strep.	Good	Vaccine
198	|6-7	Infected teeth	Sacroiliac	Strep.	Good	
199	4-5|5	Infected teeth	Sacroiliac	Strep.	Good	Vaccine
200	|6	Infected teeth	Bursitis	Strep.	Good	Vaccine

RC=root canal cultures.

Table II represents ten years' research of 426 cases. This includes the dental and medical histories, the bacteriologic findings of vital and nonvital teeth, and the results of autogenous vaccines.

TABLE II

BACTERIOLOGIC FINDINGS

	POSITIVE CULTURES	NEGATIVE CULTURES	TOTAL
Nonvital teeth	333	28	361
Vital teeth	43	22	65
			426

VARIETIES OF BACTERIA FOUND	
Streptococcus nonhemolyticus	335
Streptococcus hemolyticus	12
Staphylococcus albus (contaminations)	18
Enterococcus	3
Diplococcus	2
Vincent's	6
Fusiform	1
B. coli	1
No growths	48
	426

Sixty-two patients were given autogenous vaccines: 54 showed good results, and 8 showed no results. All teeth were radiographed and pulps were tested.

CONCLUSIONS

Nonvital teeth do not necessarily harbor infection, nor are all vital teeth free from infection.

Teeth, although infected, may not necessarily be the primary focus of a systemic disease.

The dental medical history plays an important part in dental diagnosis.

When indicated, the use of autogenous vaccines has been efficacious.

5 EAST FIFTY-SEVENTH STREET

PRACTICE OF EXODONTIA

Postoperative Complications and Some Means of Preventing Them

A. Malcolm Smith, D.D.S., F.I.C.A., F.A.C.D., Tampa, Fla.

THE history of the removal of teeth dates back to the time of Hippocrates. In days gone by, the "pulling of teeth," like the art of cupping, was the barber's job. For a good many years, however, the expression "pulling teeth" has been abandoned, and the "removal" or "extraction" of teeth has been practiced as a specialty of dentistry. We must dip into history in order to evaluate modern views with the early status of the specialty.

Exodontia began with the handicap of being practiced by barbers of early times. Probably dentistry started with a disadvantage, when in about 1835 it became a separate profession because of a slight misunderstanding between some of the members of the medical and dental profession of that period. As a result, the removal of teeth has been practiced for many years in an unclean, unscientific and unsurgical manner. It has been ridiculed and mocked in comic publications and on the stage. This degrading attitude developed because exodontia was regarded more or less as a joke.

In more recent years we have come to realize that the extraction of teeth is a serious procedure; that it is a surgical operation and that at times the patient's life depends upon the method by which the operation is performed. It has taken many years to arrive at this conclusion, just as it has taken a long while to appreciate the fact that dentistry is an essential part of medicine.

It is now generally conceded that the removal of teeth is a surgical procedure and that it requires special equipment and training and should be practiced with a definite technique. We have learned that when teeth are extracted in a rough, unclean and unintelligent manner, often a great deal of suffering may follow, which is caused chiefly by infection, by injury to the nerves, and by the formation of an undue amount of scar tissue. The death of the patient may result from the operation in the above described manner.

Exodontia is a part of oral surgery, and oral surgery is a branch of general surgery. In removing teeth we perform a surgical operation on living tissue, which involves the shedding of blood. The nerves and blood vessels, lymphatics, muscle fibers, and bone are involved in this procedure. We also have to consider the physiology and anatomy of the parts.

When we undertake to handle acute infections of the mouth, we enter a field similar to infections in other parts of the human body; and regardless of our skill and management, some cases will give serious if not fatal results. When one undertakes this type of surgery, he should be prepared and willing to assume the responsibilities imposed upon him.

Read before the Miami Dental Society, December 12, 1936; and before the Richmond, Virginia, Dental Society, May 27, 1937.

The diagnosis and the removal of dental foci are important in the practice of dentistry. One frequently is asked the question, "Why remove these impacted third molars if they are doing no harm?" In the vast majority of cases these impactions do much harm, and eventually they will prove objectionable and troublesome. I, personally, have seen two patients who were being treated for cancer of the jaw which in the end proved to be nothing more than infection and irritation from impacted third molars. The other teeth had been extracted and the impacted teeth were beginning to erupt, causing what appeared to be a pathologic process. Since we have learned that infected and malposed teeth cause systemic disturbances such as neurasthenia, neurosis, hysteria and even insanity, as a result of continued pressure and irritation of dental nerves, causing a reflex disturbance perhaps in the brain itself, their removal should be given serious consideration.

"Osteomyelitis following tooth extraction" is the diagnosis frequently seen on a hospital chart where a patient has been hospitalized following the removal of teeth. It is not often the case that cellulitis or osteomyelitis follows the extraction of teeth, but when the physician has occasion to know about the complications that sometimes follow our operations, he naturally becomes alarmed because he knows the serious and sometimes fatal consequences that follow these affections. This diagnosis would indicate that the extraction of the tooth caused the osteomyelitis, where, as a matter of fact, the patient may be only suffering with an acute cellulitis or adenitis and may not have any involvement of the osseous structure, due to the fact that adequate drainage had been established by the timely removal of the tooth from its bony socket. This procedure has no doubt checked thousands of cases of osteomyelitis, as it is usually the simplest and most effective way to establish drainage from the jaw bones. Sometimes, however, osteomyelitis does develop in spite of the removal of the tooth. The so-called "dry socket" is nothing less than a circumscribed osteomyelitis which nature keeps in check.

Pyorrhea and trench mouth often begin in pockets caused by loose gum flaps about a partially impacted tooth. Some authorities say that it is bad practice to lance or remove the operculum of the gum that covers partially impacted third molars, that this is a useless procedure because it is not the gum tissue but the overlying osseous structure that is preventing the normal eruption of the tooth, and to lance the gum tissue is likely to disseminate infection throughout the glands of the neck. It is better to treat the condition by irrigation and the use of mild antiseptics until the acute condition has subsided and then remove the tooth. Headaches and earaches are quite commonly found associated with impacted teeth. Personally I have seen several cases of Bell's palsy clear up in just a few days after the removal of abscessed teeth.

Pollia of Los Angeles recently reported six cases in which fatal termination followed the extraction of teeth, and doubtless in the last few years of economic depression there has been an increase of such cases in which fatalities have occurred because of the fact that people have been without funds to have the necessary dental work done. This means that we have to deal with infections of a more advanced nature in a patient with lowered resistance, with possible bone involvement or an incipient osteomyelitis before the operation is be-

gun. Hardly a month passes that I do not see a patient who is suffering serious consequences following the removal of infected teeth, in the form of osteomyelitis, Ludwig's angina, or cavernous sinus thrombosis.

I wish to mention some of the things that we have found helpful in preventing postoperative complications.

Diagnosis.—Know the existing conditions before starting to operate. While it is not practicable to radiograph every tooth before extraction is attempted, it should be done whenever possible. Remember that not only the infected tooth is to be removed, but all surrounding infection and necrotic bone.

Preparation.—The mouth should be thoroughly cleansed and prepared before operation. Tartar should be removed from the necks of the teeth. The mouth should be well sprayed with a good alkaline antiseptic solution, using from 15 to 20 pounds pressure in order to reach the infection under the free margins of the gums. Gingivae should be painted with tincture of metaphen or some other good antiseptic. In fact, every mouth should have this preparation prior to every inhalation anesthetic, whether it is for oral or general surgery.

Anesthetic.—Never inject a local anesthetic solution into inflamed gum tissue because, as a result of the pressure applied, emboli of living organisms may be forced into the venules which might disseminate the microorganisms throughout the body, and cause (general) septicemia. Nitrous oxide and oxygen is the anesthetic of choice in these cases.

Trauma.—Trauma should be minimized by using sharp chisels or ossisectors for excising osseous structure instead of burs or drills, because grinding instruments create considerable heat and clog the cellular spaces with small devital bone particles which tend to create infection.

Postextraction Treatment.—Never curette a socket where there is acute inflammation because curetting tends to spread infection by tearing down the wall that nature has provided to protect the patient; instead, use a suction tip to aspirate the infected material from the socket. Where the gum tissue is lanced or there has been much trauma in removing a tooth, it is best to insert a gauze drain in order to maintain drainage.

Postoperative Care.—Apply an ice bag to the face for the first twelve to twenty-four hours. Cold applications control swelling, pain and bleeding, but after edema has occurred, hot applications may be applied. If heat is applied to the face before the infection has had a chance to drain from the tooth sockets, it may cause it to break down into pus and involve the entire bone. A warm saline mouth wash may be used after six hours, but not with sufficient force to disturb the normal blood clot which serves to protect the socket. Indiscreet use of hydrogen peroxide as a mouth wash has caused bone infection to develop; because of its effervescing qualities, infection may be forced into the cellular spaces of the osseous structure.

Postoperative Hemorrhage.—Hemorrhage, one of the common postoperative complications, can be largely prevented by the use of drugs, such as calcium, fibrinogen (oral), or ceanothyn, being administered prior to or immediately after

operation. Normal blood clots in about three to five minutes, and if a clot is slow in forming, one of the above named drugs is administered before the patient leaves the office and the patient is instructed to refrain from rinsing the mouth, as rinsing tends to break down the normal blood clot. It is much better to control hemorrhage by internal medication than to pack sockets, because in packing you retard healing and are likely to have a dry or infected socket later. Stimulants or anything that will raise blood pressure should be avoided. One-sixth to one-fourth grain of morphine with one-one hundred fiftieth grain of atropine may be given to ease the patient's mind and induce sleep. Horse serum is to be avoided on account of anaphylactic shock.

Postoperative roentgenograms should be made in order to see that the sockets are free from roots, infection, or foreign bodies. Each patient should be given written or printed instructions on postoperative home care, and kept under observation until sockets are thoroughly healed.

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601 Stovall Building

LARGE CYST OF LEFT MANDIBLE

VERNOR H. EMAN, D.D.S., GRAND RAPIDS, MICH.

C McN., aged thirty-eight years.

. *History.*—Patient had noticed a swelling growing over the left jaw for the past year. He presented to his own dentist, who believed that he had an abscessed molar. Without any x-ray pictures being taken, this dentist, believing the swelling due to an alveolar abscess, removed the mandibular left molar. A large amount of pus drained and he noticed a large concavity in the bone. Lateral plates were then taken, and the patient was referred.

Fig. 1.

Examination revealed a marked enlargement of the mandible from the first bicuspid to the third molar. There was drainage of purulent matter on the lingual surface, and much bone destruction was evident.

X-ray Report.—"Region: Left lower molar area. Findings: The horizontal ramus of the mandible on left shows a circular area of rarefaction, one and one-fourth inches in diameter. The borders are fairly sharp and no trabeculation is noted. The inferior border is greatly thinned and expanded. There are no unerupted teeth seen. Impression: Large bone cyst of left mandible, horizontal ramus."

Operation.—At the hospital under block anesthesia, an incision was made along the superior border of the mandibular ridge, which was carried down just anterior to the first bicuspid. The entire area was then opened widely,

and complete destruction of the lingual plate from the third molar forward to the second bicuspid was noted. The cyst membrane was completely enucleated. It was found necessary to leave the buccal cyst wall in order to prevent pathologic fracture of the bone.

Treatment.—The wound was irrigated and dressed loosely with iodoform strip gauze on alternate days. Healing was uneventful and the buccal bone wall slowly returned to position. There was a defect left on the lingual surface, but an appliance can be constructed over it later.

Pathologic Report.—"Operation: Enucleation of cyst of mandible. Date: 10/26/37. Operator's diagnosis: Radicular cyst of left mandible. Description of gross specimen: Tissue consists of contents of a bone cyst. Microscopic sections: Sections from the tissue removed from the jaw show a mass of vascularized, granulation tissue, deeply infiltrated with inflammatory blood pigment and in one area it contains many cholesterin clefts. Diagnosis: Broken down epithelial cyst with moderate inflammatory exudate."

622 Medical Arts Bldg.

BAYONET INCISION FOR TEMPOROMANDIBULAR ARTHROTOMY

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THE difficulties and dangers inherent in surgery of the temporomandibular joint are rendered the greater by the necessity for approaching the operative field through a relatively small skin incision. Projected upon the surface of the face, the jaw joint lies just beneath the zygomatic arch, at about the level of the tragus of the ear. Just behind it, in front of the ear, the auriculotemporal nerve and the superficial temporal artery ascend. Farther forward, the frontal branch of the facial nerve courses obliquely upward across the zygomatic arch. This roughly outlines a triangular area, the base of which

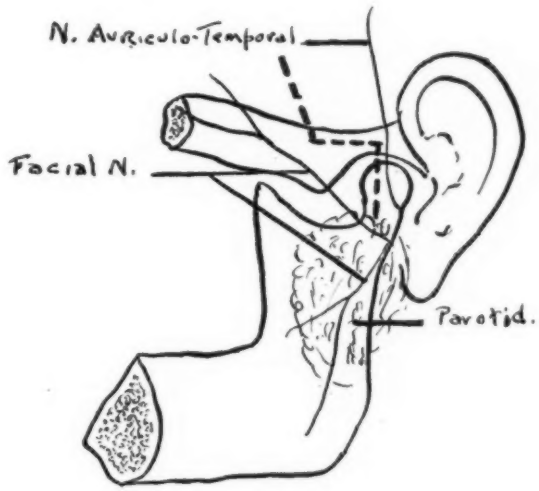

Fig. 1.—Sketch showing approximate projection on the face of the temporomandibular joint, the facial and auriculotemporal nerve, with relation of the proposed incision, which is indicated by the broken bayonet-shaped line.

is the zygomatic arch, the sides, the two nerves just mentioned. The apex, at the point where the facial nerve makes its appearance upon the face, lies just above the parotid gland.

To overcome this topographical limitation, different types of incisions have been described. Some are entirely vertical; others are entirely transverse; while the majority are combinations of the vertical and horizontal incisions. The difficulty has, of course, been that the transverse incision endangers the vertically coursing artery and nerves, while the vertical incision gives inadequate exposure. To overcome these difficulties a new type of incision was devised. It seems to meet all the necessities of the situation and has been used with satisfaction in several different types of cases.

The incision is somewhat bayonet shaped and consists of a transverse portion made at the level of the zygomatic arch. Forward it extends to somewhat less than half the distance between the tragus and the orbital rim. At this point, within the hair line, the ascending arm of the incision is made. Posteriorly the horizontal portion of the incision extends to just in front of the ear, at which point the descending arm is made. To avoid injury to the facial nerve, the descending line is carried below the level of the tragus, only with great circumspection. Made in this manner, the incision, when healed, is almost invisible, since it lies mainly within the hair line.

This incision has certain advantages over those heretofore described. While giving the maximum of vertical exposure, it also gives the maximum of horizontal exposure, without unnecessarily endangering the nerves and especially the frontalis branch of the facial nerve. If necessary, the horizontal portion of the incision may be readily extended backward, after the manner of Barsim. The scar is hidden.

225 West 86th St.

IMPROVED DETAIL AND MOUNT FOR ROENTGENOLOGIC DIAGNOSIS

J. Holden Beckwith, D.D.S., Miami, Fla.

THE importance of good dental x-ray pictures cannot be overemphasized, as they are an excellent means of thoroughly diagnosing the teeth and surrounding parts for the prevention of loss of teeth.

I believe roentgenology is the most outstanding aid to the dental profession in the recognition of pathologic conditions of the mandible and the maxilla. It is astonishing to note how few articles on this important subject

Fig. 1.

have appeared in the leading dental journals within the past few years. Possibly the lack of such publications is the major reason for carelessness and negligence on the part of the dentist in this particular phase of dentistry.

In presenting this celluloid mount which is a great improvement over the ordinary pasteboard holder, I wish to state that not only better detail is obtained but the general aspect is more dignified and compact. For best results, the following procedure is suggested.

A photographic picture must be made of the pasteboard holder, preferably 8 × 10 inches, as this is the size of photographer's frame. From this mount print celluloid pattern which may be used over and over. Develop dental radiograms as in regular routine. After they are thoroughly dry, properly place them on finished celluloid pattern. X-ray pictures can be more easily placed if pattern is on white background. With very thin and tiny strips of transparent Scotch cellulose tape, attach each x-ray picture at upper left and lower right corners. Radiograms must be mounted down on pattern with glossy side up. Mounted pattern is now ready for exposure. In the dark room, place mounted pattern in 8 × 10 inch printing frame, over which fit a celluloid film. Close the frame, and expose from eight to ten seconds under sixteen-watt lamp, which should be at a distance of two feet. An indirect print will result. Repeat exact process for direct film. In order that the transparent windows remain spotless, wash the glossy side with wood alcohol. The alcohol must not be applied to the emulsion side. If one does not wish to do this detail work, the mounted celluloid pattern may be taken to any Eastman concern where a final print can be made ready for a very small fee. The complete procedure, although seemingly quite difficult, is very simple and requires very little extra time and effort.

With this new type of x-ray examination, which affords more thorough diagnosing, we are able without difficulty to gain the confidence of the public, which obviously we seem to have lost within the last few years.

In the past, roentgenology has been unrightfully neglected and considered a minor and unimportant phase of our profession. We need a standard technique for the interpretation of radiographs whereby we may intelligently inform the patient as to the exact condition of his mouth. We also should spend more time in educating our patients to realize the essential importance this phase should occupy for a healthful prolonged life. We must instill within them a desire to want improved dental diagnosis instead of the growing desire for just price. When this has been accomplished, our responsibility has been fulfilled and ceases.

432 Ingraham Bldg.

Department of Orthodontic Abstracts and Reviews

Edited by

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Oral Diagnosis and Treatment Planning. A Textbook for Students and Practitioners of Dentistry and Medicine. By Samuel Charles Miller, D.D.S. Philadelphia, P. Blakiston's Son & Co.

This new textbook on oral diagnosis is another expression of the modern trend in dentistry toward a scientific study of dental diseases. Instead of being concerned mainly with the technical construction and reconstruction, dental diagnosis is more closely resembling medical diagnosis.

As the magnitude of the subject was considered to be beyond the scope of one man, several contributors were invited to treat their own particular field. Dr. Miller outlines the purpose of the book in the first chapter: "The Science of Oral Diagnosis." Head pains (cephalalgia) are discussed by R. H. Behan as to their etiology, interpretation and significance. The pain of dental origin is taken up in greater detail by John Oppie McCall, who uses the following basic subdivisions: pulp inflammation, systemic conditions, pericementitis, gingivitis, pericoronitis, abscesses, tooth surface sensitivity, postoperative pain, temporomandibular joint pain, salivary glands, malignant growth, and focal infection.

Mouth conditions in children are covered by J. Newton Kugelmass by means of an adequate number of illustrations and diagnostic tables. Following this, McCall adds a chapter on dental and periodontal diseases in children. In concise and masterly fashion, he describes the symptoms of odontoclasia, enamel hypoplasia, caries, enamel decalcification, gingivitis, and pocket formation. The text is exemplified by well-reproduced roentgenograms. The rationale of control and the preventive principles applying to the dental disease of children are particularly stressed.

George Miller MacKee and Anthony C. Cipollaro consider the diseases of the oral mucuous membrane. Several photographs in natural colors demonstrate the superiority of such reproductions to the process of hand painting. Radiographic interpretation is described by Abraham L. Greenfield; and an interesting chapter on diagnosis of the abnormalities of the temporomandibular articulation is written by Sidney E. Riesner.

The diagnosis of surgical conditions is taken up by Theodor Blum in a most instructive and well-arranged article which also contains many splendid illustrations. According to the author, malposed teeth should be either brought into their normal positions or removed, for the following possible complications: in-

fection, trismus, peritonsillar abscesses, decay, absorption of contacting tooth, crowding, nervous reflexes, facial neuralgia, formation of follicular cysts, and foci of infection.

The chapter on incipient periodontal disease is written by Harold Keith Box and J. Lewis Blass; the chapters on advanced periodontal disease and its treatment are written by the editor, Samuel Charles Miller. They contain valuable information and are well illustrated. Alfred Walker discusses, in a clear and instructive manner, the detection and diagnosis of caries, and the diagnosis of pulp abnormalities and pulp testing. The lesions of the hard structures of the teeth and choice of treatment are dealt with in a separate article by Finn J. Bronner; he classifies those factors which govern the choice of restorative procedures, considers various stains found on teeth, and evaluates the rôle of desensitizers.

In the realm of prosthetics, Carl J. Knapp covers the diagnosis for bridgework and bridge design; Clyde H. Schuyler the partial denture design, and Merrill G. Swenson the diagnosis and design of full dentures.

Diagnosis in orthodontia is contributed by Samuel Hemley, who, on the whole, follows the classification of Angle. Exception may be taken to Fig. 21, a diagram which illustrates bone resorption on the labial and bone deposition on the lingual wall of the alveolus if "gentle intermittent pressure" is applied in a labial direction. Under the influence of the appliances suggested (non-bodily), the bone changes at the apex of the tooth occur in manner and direction opposite to those at the alveolar border; which factors, together with their occlusal components, are inadequately if not incorrectly demonstrated in the diagram.

In the treatment of Class III conditions, too much pessimism is evidenced by the author's belief that such malocclusions cannot be corrected because tension stresses would be needed to reduce the size of the mandible and "tension will destroy bone." There is no support for this latter statement; as a matter of fact, tension stimulates bone growth, does not destroy it. Questionable also is the author's statement that "it is not possible to reduce the size of a bone after it has grown, except by surgical intervention. This refers to the bodies of the maxilla and mandible." There is no line of demarcation between alveolar process and jaw bone proper, but the trabecular structure is continuous. The alveolar process supports the teeth and changes with them, but the body of the jaw bone supports the alveolar process and changes with the latter. All tooth movements have a far-reaching effect and skull measurements as well as radiographic studies show that the jaw bone proper and the ramus of the mandible are affected by orthodontic treatment. Class III malocclusions have frequently been treated with good success, especially if endocrine factors were properly taken into consideration.

Harold Stearns Vaughan contributes a chapter on mouth infections and their relation to systemic diseases, in which he maintains a sound but conservative attitude toward the subject. Next follows a discussion of the oral manifestations of endocrine dysfunctions by William Wolf, and an interesting section on oral and dental diseases of occupational origin by J. A. Salzman. The laboratory diagnosis available to the dentist is described by Charles G. Darlington

with the exception of the phases including oral bacteriology, which are dealt with by Julius Klosterman. The portion of the book devoted to oral pathology is closed by Frances Krasnow's chapter on salivary analysis, dealing with the constituents of saliva, its acidity and alkalinity, and the relationship between saliva and caries.

This summary is in itself conclusive of the completeness of the volume and the thorough manner in which all pertinent problems have been covered. It is not a criticism if the reviewer questions its value as a textbook for students, for the simplicity of a presentation by one author is needed for such a purpose. But the greater is its value as a reference book for the dental and the medical practitioner. What I like most in the arrangement of the text is the clever use of different printing type to subdivide the subject matter; and the separate, extensive list of references which follows each chapter. There is also an index of proper names and a subject index; a table of contents and of the contributors; and a large chart of simplified technique in cavity preparation based on mechanical principles (Bronner). The reader whose curiosity is aroused by this description of the volume will not be disappointed by the actual perusal of it.

Egon Neustadt.

Editorial

Can Decay of the Teeth Be Prevented?

DECAY of the teeth not only can be prevented but is being prevented daily. There is possibly more misinformation about the decay of the teeth and the cause and cure of so-called pyorrhea than there is about any one other single subject, except perhaps religion. How true Josh Billings has written, "It *ain't* so much what folks don't know as 'tis they know so much what *ain't* so." There is nothing permanent except change. The American public is often placed in such a quandary because of the manifold theories, disagreements, advertisements, and lack of definitely proved useful knowledge on the subject from those who are supposed to know, or from those to whom a person may go for help, that all too often the public is forced to doubt the efficacy of dentistry and the absolute importance of availing itself of what can be and is being done to control this greatest disease of the human race, dental decay.

There is no magic, mysterious short cut to glorious good health. No university can teach us, through one of its extension courses, how to prevent decay of the teeth. The greatest philosopher of our day cannot philosophize away the toothache. No medicine or proprietary preparation sold in a jar, tube, box, can, or bottle will prevent our teeth from being ravaged by decay. No single factor will do the job to every one's satisfaction, and no individual or organization can guarantee us against the scourge of decaying teeth. But the picture is far from hopeless and helpless; the remedy is fairly simple, it concerns mainly the most important person in our life, because the method of preventing decay of the teeth rests almost entirely with the individual.

What are teeth, when are they formed, why are they different from any other part of our body? Our hygiene lesson in public school taught us that teeth are hard, bonylike projections growing in the jaws, and are used for biting and chewing so that we can swallow more comfortably the food we eat. Teeth are vital, living, important parts of our body. True, teeth are the hardest substances found in the body, for the enamel covering of the portion of the teeth which shows above the gums is the hardest known structure in the body, much harder and denser than bone. Teeth not only are accessory organs of speech, but are necessary to the maintenance of buoyant health. We must have well cared for, comfortable teeth if the process of digestion is to take place normally. Teeth give form to the face, and they influence the features by which individuals are appraised and identified. It is from the mouth and chin that disposition and character are most assuredly to be judged. Teeth are in many instances one of the main indices as to what is actually taking place in the body. The diseases affecting the teeth always have a close relationship to the health of the whole body. Many of the diseases to which we are heir first manifest themselves to the well-trained physician or dentist by

the condition of the mouth or the teeth. When decay of the teeth is allowed to run rampant, toxins are generated and disseminated throughout the body, attacking the weakest parts and the most vital organs.

The twenty baby or deciduous teeth are formed four to six months before the child is born. What the mother eats during the pregnancy, what happens to her from a health standpoint before the baby arrives, has everything to do with the kind of teeth the baby will have. The mother alone is responsible for the teeth of her child. These twenty deciduous teeth are supposed to serve the individual through life's most critical and trying periods—infancy, babyhood, and childhood to adolescence. This is the time of life when the nervous and digestive systems do most of their developing; when contagious and infectious diseases are accosted; when food or eating habits are firmly fixed. Every child deserves the right to be well born, to be given a chance to grow in wisdom and stature, in favor with himself and his fellow men. The first permanent teeth which erupt are also being formed at birth, and because so little attention is given this important matter, more defects are found in the first of the permanent teeth than in nearly all the other permanent teeth put together. Guard well those first permanent teeth which erupt behind the last deciduous teeth before any of the deciduous teeth are lost. Teeth are different from other organs of the body in that they are the only structures in the body in which there is no natural provision for repair when damage or infection once gains admission. If an arm or a leg is broken, whether one goes to a physician or not, that arm or leg will heal itself; it may not heal straight, but it will repair itself. If a nerve or blood vessel is cut or damaged, unless it is one of the vulnerable nerves or blood vessels, repair and regeneration will surely occur; but not so with a tooth, for once it is fractured or cracked, or a cavity appears in any one of its five surfaces, then that tooth progressively gets worse, and finally toothache, an abscess formation and death of the tooth result, causing a change in shape of the whole mouth and face, affecting seriously the sinuses, the air passages, digestion, and acting as a breeding point for the most virulent of poisons found in the body.

Diet alone will not prevent teeth from decaying. Brushing the teeth and gums with any and every dentifrice, mouthwash or germicide on the market will not, by itself, prevent decay of the tooth. Going to the dentist from early childhood to old age and senility will not protect against decaying teeth. No one thing can or will prevent decay of the teeth because we do not know in every instance what causes teeth to decay; but we do know that by a strict program of all three of these all important avenues to success; namely, (1) proper diet and nutrition, (2) intelligent home care and hygiene of the teeth and mouth, proper exercise and stimulation of the gums and teeth, and (3) regular and systematic visits to the dentist early in life and at intervals so that the dentist might have opportunity to aid in keeping the teeth in good repair and the all important preventive and health service he alone is capable of giving the mouth and teeth; this trio can prevent decay of the teeth.

Strong, healthy, useful teeth are the result of:

1. Good nutrition—with particular stress on the attention to the health of and the proper selection of foods for the expectant and nursing mother,

the preschool and the school child. Sane eating habits, proper, thorough mastication or chewing on both sides of the mouth. Proper mastication is a first aid to digestion and is also necessary for jaw and tooth development in childhood and for maintaining the health and supporting tissues all through life. We should eat what we ought to have rather than what we think we should have. We should have regular meals at regular times, with supervised or controlled eating between meals.

2. Adequate home care of the mouth and teeth includes thorough and systematic cleaning and stimulation of the mouth and teeth at least each morning and night, oftener if possible. The toothbrush best adapted to the mouth should be intelligently selected and used. The dentist should teach the best method to employ in brushing and massaging the teeth and gums. If certain abnormal or unusual conditions are found in the mouth, those conditions will, of course, require special instructions and care. The person with so-called crooked teeth has much more difficulty keeping the mouth and teeth healthy than does the person with a well-rounded arch and a strong, well-supported set of teeth.

3. Regular and systematic visits to the dentist. The dentist should be selected with as much care as the physician. A child should be acquainted with the dentist by two and one-half years of age, earlier than this if stains or defects are noticed on the teeth. The child and the adult should visit the dentist as often as the dentist deems necessary to do well his part in preventing the teeth from suffering losses he cannot control. No defect is too minor to require immediate attention. No cavity or hole in a tooth, in either child or adult, is ever too small to fill. Every deciduous tooth should be retained and repaired to assure its remaining in a healthful, useful condition until the succeeding permanent tooth replaces it in that particular mouth. It requires time to make a real examination; every tooth has five surfaces, and there are one hundred surfaces to be examined above the gums in the mouth of a child five years of age; there are one hundred and sixty surfaces to be examined in an adult's mouth. No examination is or can be complete without the aid of the x-ray, for the dentist cannot tell what is lurking beneath the gums. Most boys and girls have defects in their first permanent molars, and all the molar teeth—because of the structural defects almost always found in them. They need a close examination and usually a preventive treatment soon after their appearance in the mouth. Any defect which causes pain, toothache or discomfort makes the dentist's chance of helping a great deal more hopeless. If parents, individuals, and dentists all did their part, decay of the teeth in most instances could be prevented.

Walter T. McFall.

In Memoriam

Ray W. Noland

Ray Walter Noland, of Des Moines, Iowa, died very suddenly at his home, Sunday, October 3, 1937, of coronary thrombosis.

He was graduated from the Dental College of the State University of Iowa in 1917, and entered general practice for two years. He took postgraduate work at the Dewey School of Orthodontia in New York in 1919, and from that time until the time of his death, he practiced orthodontia exclusively.

He was a faithful and active member of the American Society of Orthodontists. He was a member of the Des Moines District Dental Society, the Iowa State Dental Society, the American Dental Association, and the local medical society. He was president of the G. V. Black Dental Study Club of Des Moines.

He was a prominent figure in the state organization of the Delta Sigma Delta, being president of the Building Association, and past Grand Master, both while in school and later of the Iowa Auxiliary. He was also active in civic life—chairman of the Boys' and Girls' Committee of the Lions Club, member of the Capital Masonic Lodge and of the Order of the Shriners.

He is survived by his wife and three daughters.

Dr. Noland's great interest, aside from his orthodontic practice, was horseback riding, and even in winter months he was up bright and early every morning for a brisk canter. Dr. Noland's cheerful smile and sunny disposition will be greatly missed by orthodontists everywhere. His practice will be continued by Dr. James S. Hoffer of Des Moines, who was associated with him.

Eugene Floyd Buckley

1883—1938

Eugene Floyd Buckley, of Little Rock, Arkansas, passed away on January 9, 1938, at the Little Rock Hospital after a very short illness.

He was born in 1883 in Liberty, Missouri, the son of Dr. and Mrs. W. H. Buckley, and had lived in Little Rock, Arkansas, since the age of nine. He attended the Arkansas Military Academy prior to entering Kansas City Dental College where he was graduated in 1908, later taking postgraduate courses in the Dewey School of Orthodontia and at Columbia University, New York City. He began his practice in Little Rock in 1910 and continued in practice in that city until the time of his death.

Dr. Buckley was a member of Sigma Delta dental fraternity, of the Arkansas State Dental Society, of the American Dental Association, and of the American Society of Orthodontists, besides being active in many organizations in his community.

He was the pioneer of the specialty of orthodontics in the state of Arkansas and was for many years the only dentist engaged in the exclusive practice of orthodontics in that state. Dr. Buckley will be greatly missed by his confreres throughout America. He was well known and was highly regarded as an orthodontist and as an outstanding citizen.

News and Notes

American Association of Orthodontists

The thirty-sixth annual meeting of the American Association of Orthodontists will be held in Los Angeles July 11 to 14. This meeting will be held at the Roosevelt Hotel, which is located within the glamorous center of Hollywood, with its many interests for visitors from other states.

DR. JAMES D. MCCOY, President
3839 Wilshire Blvd.
Los Angeles, Calif.

DR. CLAUDE R. WOOD, Sec'y-Treas.
608 Medical Arts Bldg.
Knoxville, Tenn.

Thos. P. Hinman Midwinter Clinic

The twenty-fourth annual session of the Thos. P. Hinman Midwinter Clinic will be held at the Biltmore Hotel, Atlanta, Ga., March 14 and 15, 1938.

Southwestern Society of Orthodontists

The eighteenth annual meeting of the Southwestern Society of Orthodontists will be held at the Adolphus Hotel, Dallas, Texas, March 6-9.

Dr. Oren A. Oliver and Dr. Hermann T. Becks will be the leading essayists.

All members of the American Association of Orthodontists are cordially invited to attend.

DR. HARRY H. SORRELS, Secretary
Medical Arts Building
Oklahoma City, Okla.

Five State Post Graduate Clinic

The District of Columbia Dental Society will conduct the Five State Post Graduate Clinic on March 6-9 at the Mayflower Hotel, Washington, D. C. This year the Committee has arranged a scientific clinic to conform to the principles on "Dental Health for American Youth" advanced by the president of the American Dental Association.

The following men will present papers: Dr. Malcolm W. Carr of New York; Dr. Oscar V. Batson, Graduate School of Medicine, University of Pennsylvania; Dr. Albert J. Irving of New York; Dr. Lon Morray of Chicago; Dr. Alexander H. Patterson, Professor of Prosthetic Dentistry, University of Maryland.

The afternoon of March 7, a reception will be held from 5 to 7 o'clock in honor of Dr. C. Willard Camalier, president of the American Dental Association.

DR. JOHN P. BURKE, President
Colorado Building
Washington, D. C.

Dental Society of State of New York

The seventieth annual meeting of the Society will take place May 10-13 at the Hotel Syracuse, Syracuse, New York.

DR. EDWIN I. HARRINGTON, President
Woolworth Building
Watertown, N. Y.

North Carolina Dental Society

The sixty-fourth annual meeting of the North Carolina Dental Society will be held at the Robert E. Lee Hotel in Winston-Salem, N. C., May 2-4, 1938. All members of the American Dental Association are cordially invited to attend.

FRANK O. ALFORD, Sec.-Treas.,
1109 First National Bank Bldg.,
Charlotte, N. C.

Cleveland Dental Society

The Seventh Annual Two-Day Clinic Meeting of the Cleveland Dental Society will be held April 4 and 5 at the Statler Hotel, Cleveland, Ohio.

DR. JOHN I. SLOAN, General Chairman,
Rose Building,
Cleveland, Ohio.

Southern Society of Orthodontists

The sixteenth annual meeting of the Southern Society of Orthodontists was held February 7 and 8, at Hotel Cleveland, Spartanburg, S. C. The following very interesting program was presented:

"President's Address" by Clyde O. Wells, Spartanburg, S. C.; "Diagnosis," a discussion of the Angle classification for diagnosis and an explanation of the use of Fiction in diagnosis, by Richard A. Lowy, Newark, N. J.; "Distoclusion Cases With and Without

the Guide Plane'' by Stephen C. Hopkins, Washington, D. C.; ''Growth and Development'' by D. Lesesne Smith, Spartanburg, S. C.; ''A Correlation of Concept, Principles of Treatment and Appliances'' by Andrew F. Jackson, Philadelphia; ''Appliances Designed to Expand Lower Arch by Moving Teeth on One Side Only'' by Winston P. Caine, Chattanooga; ''Practical Aids in Your Practice'' by Paul Hoffman, Washington, D. C.; ''Guide Planes'' by Stephen C. Hopkins, Washington, D. C.; ''More Stable Anchorage'' by Harry G. Jones, Indianapolis; ''An Attachment for Anterior Bands for Use in Rotating'' and ''Some Little Gadgets That I Have Found Useful in Practice'' by W. K. Slater, Knoxville; ''Models of Cases Ten and Twenty-Five Years After Treatment'' by J. A. Gorman, New Orleans; ''Improving the Hawley Plate'' by Harvey G. Bean, Toronto, Canada; ''Practical Suggestions for Building a Competence'' by John A. McPhail, Cincinnati; ''Agranulocytosis Inducing a Serious Malocclusion, With Treatment Employed'' by L. D. Coriell and H. E. Kelsey, Baltimore; ''The Control of Habits in the Treatment of Malocclusion'' by Leland R. Johnson, Chicago; ''Treatment of Neutroclusion Case'' by F. R. Aldrich, Columbus; ''Some Problems Involved in Tooth Movement'' by H. R. Churchill, Philadelphia; ''Case III Cases in Adult Patients'' by W. Tyler Haynes, Richmond; ''Neutroclusion With Infraclusion of the Molars and Supraclusion of the Lower Anterior Teeth'' by Harle L. Parks, Atlanta; ''Cooperation in Orthodontic Treatment'' by W. H. Street, Richmond.

Horace Wells Anesthesia Society

The regular scientific session of the Horace Wells Anesthesia Society was held February 14 at 9 P.M., in the Patio Room of the Hotel St. George in Brooklyn.

Dr. William Branower, anesthetist to the Mt. Sinai Hospital, Hospital for Joint Diseases, and consultant anesthetist to the Bronx Hospital, lectured on ''Resuscitation by Artificial Respiration, With Demonstration of a New Apparatus.'' The lecture was illustrated by motion pictures and stereopticon slides.

M. Lee Garland, Secretary,
781 44th Street
Brooklyn, N. Y.

Mexican Association of Orthodontics

The first Medicodental Convention in Mexico was held February 14 through 19, at the National School of Odontology of the National University of Mexico, D. F. Papers were presented by the following men: Dr. Angel Zimboron, Mexico; Dr. D. J. Aubertine, San Francisco; Dr. Felix del Paso, Mexico; Dr. George H. Grover, San Francisco; Dr. George S. Sharp, Pasadena; Dr. Leland G. Hunnicutt, Pasadena; Dr. George W. Hahn, San Francisco; Dr. Mario A. Torroella, Mexico; Dr. Spencer R. Atkinson, Pasadena; Dr. Russell W. Force, Pasadena; Dr. Alejandro Velasco Zimbon, Mexico; Dr. J. A. Linn, Los Angeles; Dr. Kenneth Terwilliger, San Francisco; Dr. George C. Chuck, Long Beach, Calif.; Dr. Arthur Smith, Los Angeles.

Great Lakes Association of Orthodontists

The twelfth annual meeting of the Great Lakes Association of Orthodontists will be held in Cleveland on November 7 and 8 at the Hotel Statler.

Richard E. Barnes, Secretary,
1704 Republic Bldg.,
Cleveland, Ohio.

American Dental Assistants Association

The fourteenth annual session of the American Dental Assistants Association will be held at St. Louis, October 24-28. For further information, address

LUCILE S. HODGE, Secretary,
401 Medical Arts Bldg.,
Knoxville, Tenn.

American Dental Hygienists' Association

The American Dental Hygienists' Association will meet October 24-28 at St. Louis.

DAISY M. BELL, Secretary,
974 Amherst Street,
Buffalo, N. Y.

Notes of Interest

Dr. J. Lyndon Carman announces the removal of his offices to 501 Republic Building, Denver. Practice limited to orthodontia.

Dr. James S. Hoffer of the association of Noland and Hoffer announces that he is continuing with the practice of the late R. W. Noland in the same suite of offices at 1113 Equitable Building, Des Moines, Iowa. For the practice of orthodontia exclusively.

Dr. H. C. Pollock and Dr. E. V. Holestine announce the removal of their offices from their former location to 8022 Forsythe Blvd., St. Louis, Mo. Practice limited to orthodonties.